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(12) **United States Patent**
Hartman et al.

(10) **Patent No.: US 11,131,413 B2**
(45) **Date of Patent: Sep. 28, 2021**

(54) **ROTATING FEMALE PORTION AND ERGONOMIC SAFETY LOCK FOR CAM LOCK FITTING**

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(72) Inventors: **Jeffrey Hartman**, Mobile, AL (US); **George L Williamson**, Fairhope, AL (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 195 days.

(21) Appl. No.: **16/570,756**

(22) Filed: **Sep. 13, 2019**

(65) **Prior Publication Data**

US 2021/0018129 A1 Jan. 21, 2021

Related U.S. Application Data

(63) Continuation-in-part of application No. 16/517,379, filed on Jul. 19, 2019, now Pat. No. 10,962,161.

(51) **Int. Cl.**

F16L 37/18	(2006.01)
F16L 37/20	(2006.01)
F16L 37/12	(2006.01)
B21D 39/04	(2006.01)
B23P 19/10	(2006.01)
F16L 37/127	(2006.01)

(52) **U.S. Cl.**

CPC ***F16L 37/18*** (2013.01); ***F16L 37/12*** (2013.01); ***F16L 37/20*** (2013.01); *B21D 39/046* (2013.01); *B23P 19/10* (2013.01); *F16L 37/127* (2013.01)

(58) **Field of Classification Search**

CPC F16L 37/12; F16L 37/127; F16L 37/24; B23P 19/10; B21D 39/046

See application file for complete search history.

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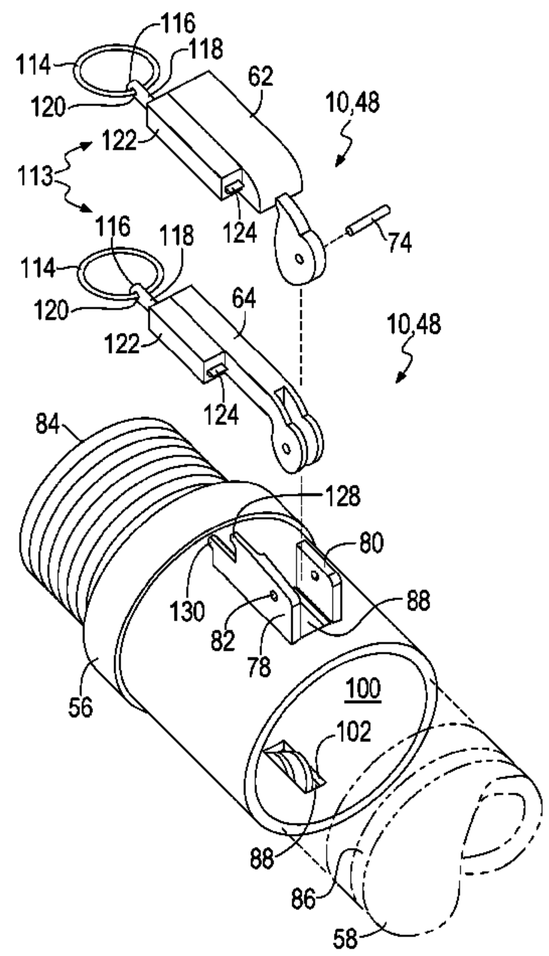
(57) **ABSTRACT**

A method and apparatus for an improved rotatable safety cam lock fitting having ergonomically designed double cam levers having outer and inner portions so that when the outer cam levers are opened and the inner cam lever remain closed, the male and female portions of the cam lock fitting only slightly separate from each other allowing the operator to quickly reclose the cam lock fitting if the operator observes that the cam lock fitting still contains pressurized material. This is accomplished by providing a larger cam lobe on the outer cam lever and a smaller cam lobe on the inner cam lever so that when the smaller cam lobe is in a closed position and protrudes into a peripheral groove on the male portion the male and female ends have a small space therein between. Various configurations of the cam portions relative to each other are provided. Various lever locking assemblies may be used to prevent the cam levers from being inadvertently opened.

14 Claims, 12 Drawing Sheets



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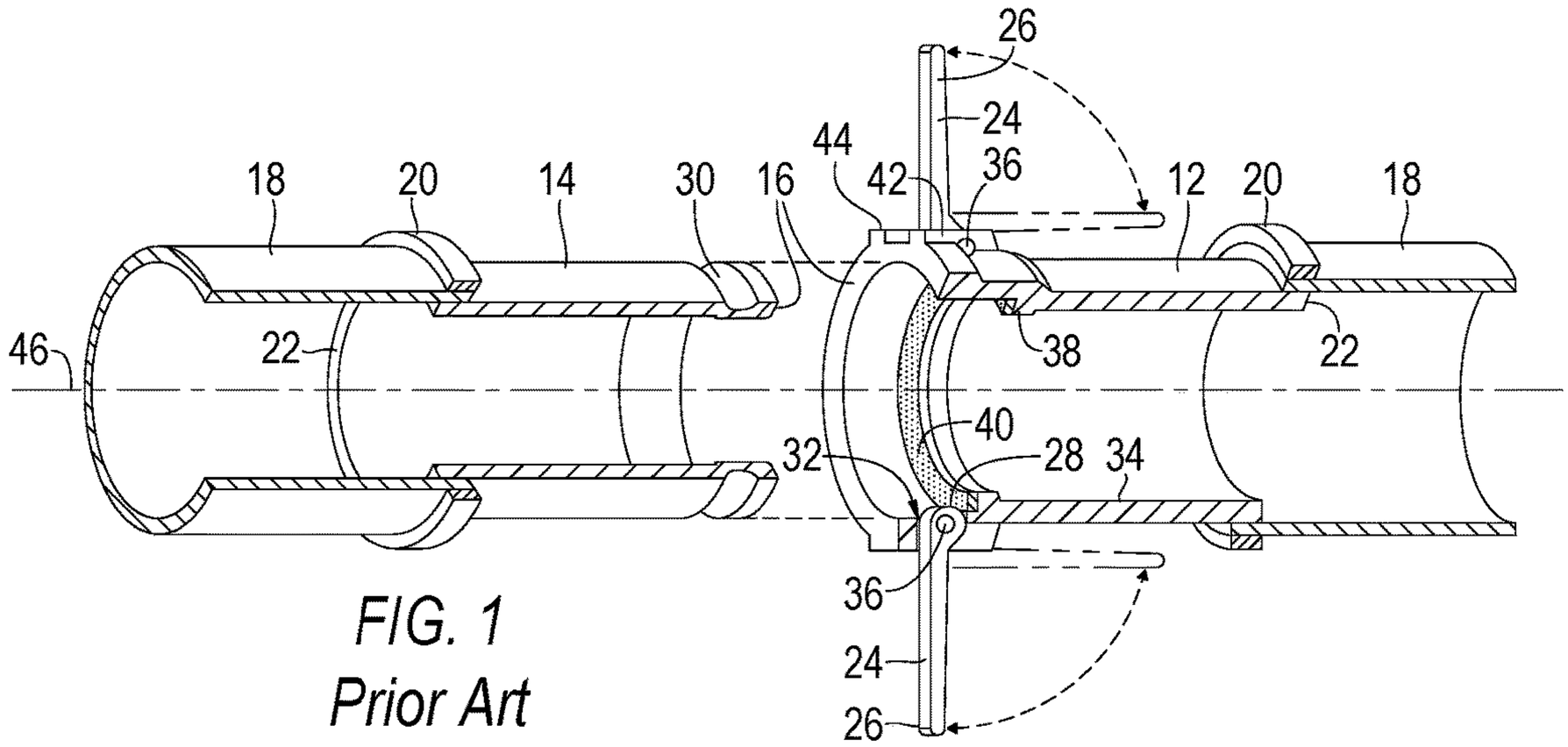


FIG. 1
Prior Art

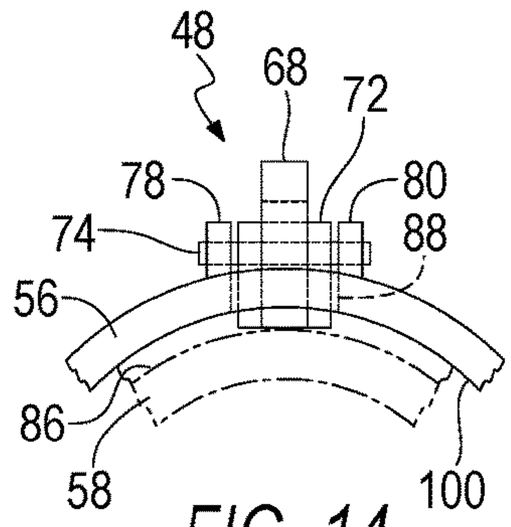


FIG. 14

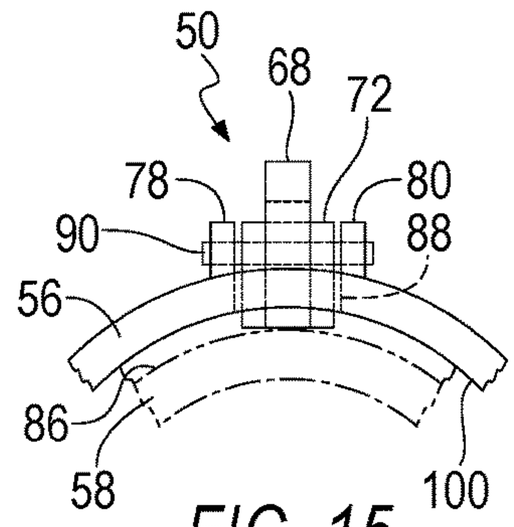


FIG. 15

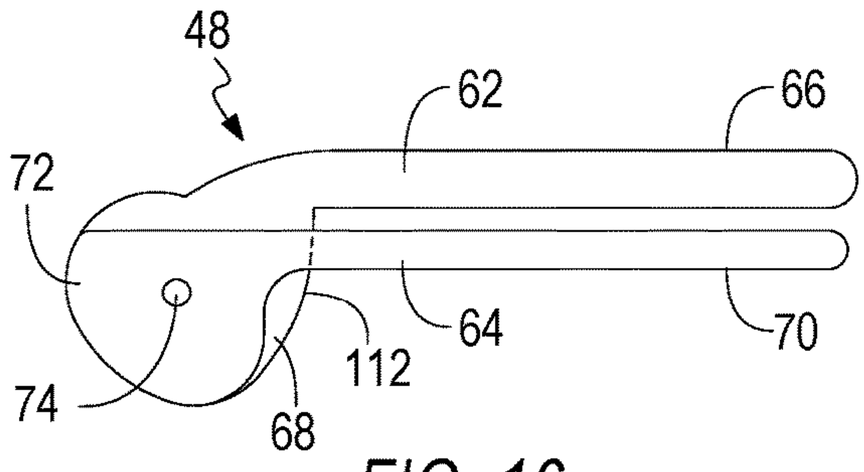
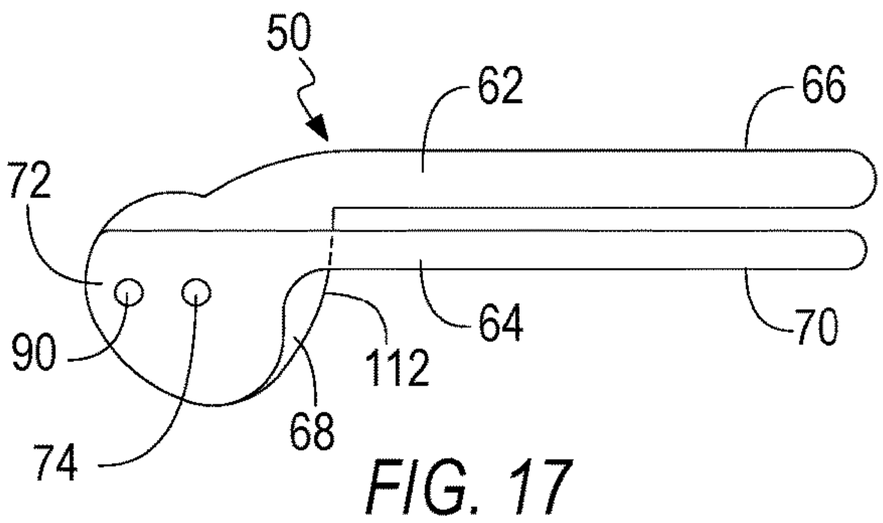


FIG. 16



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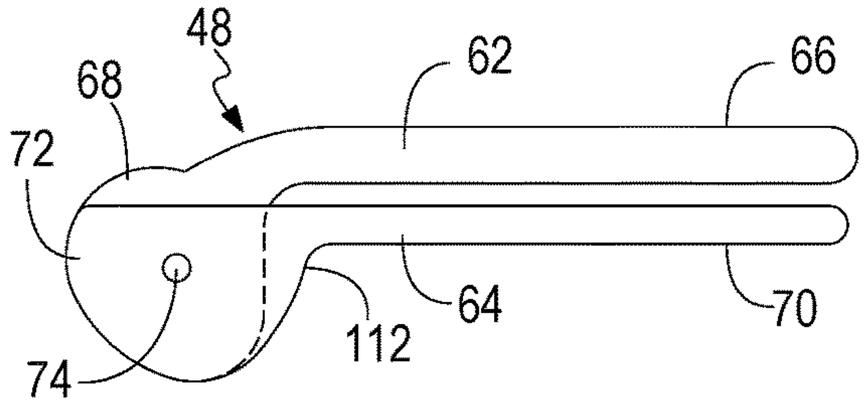

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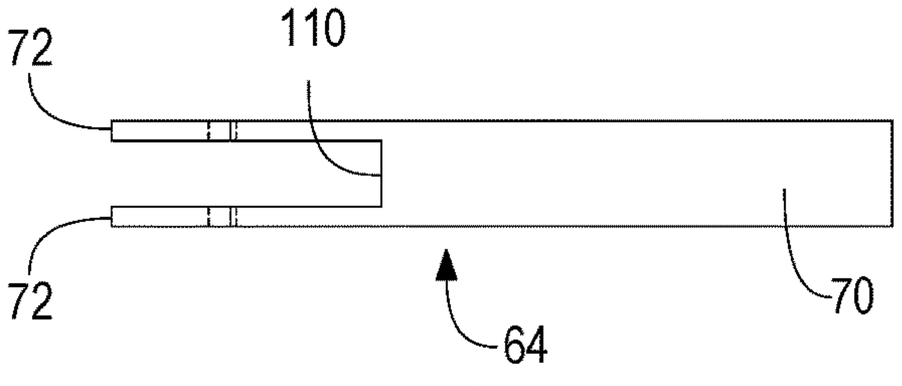


FIG. 19

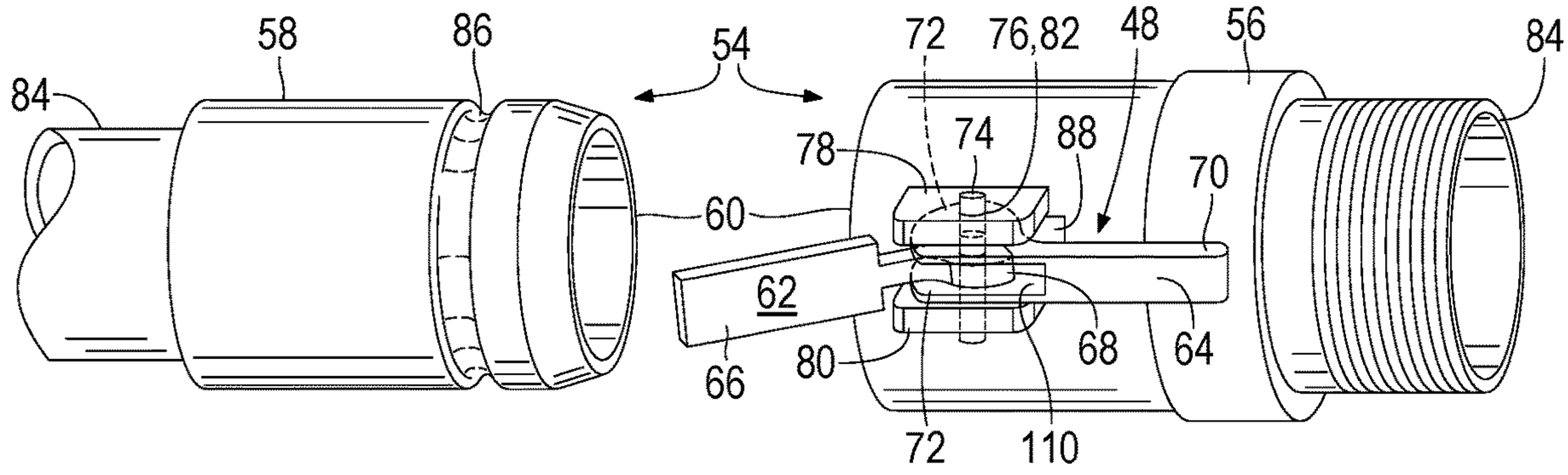


FIG. 2

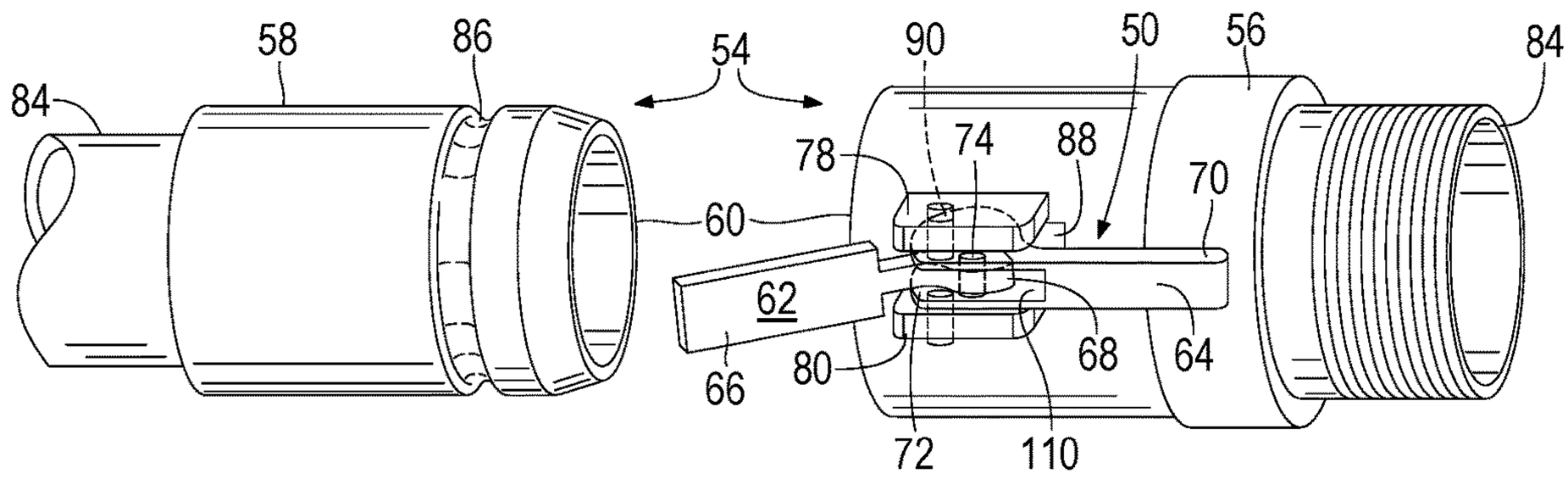


FIG. 3

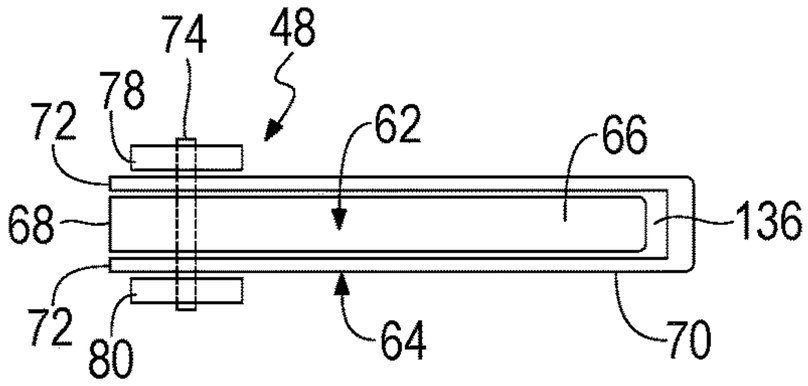


FIG. 25

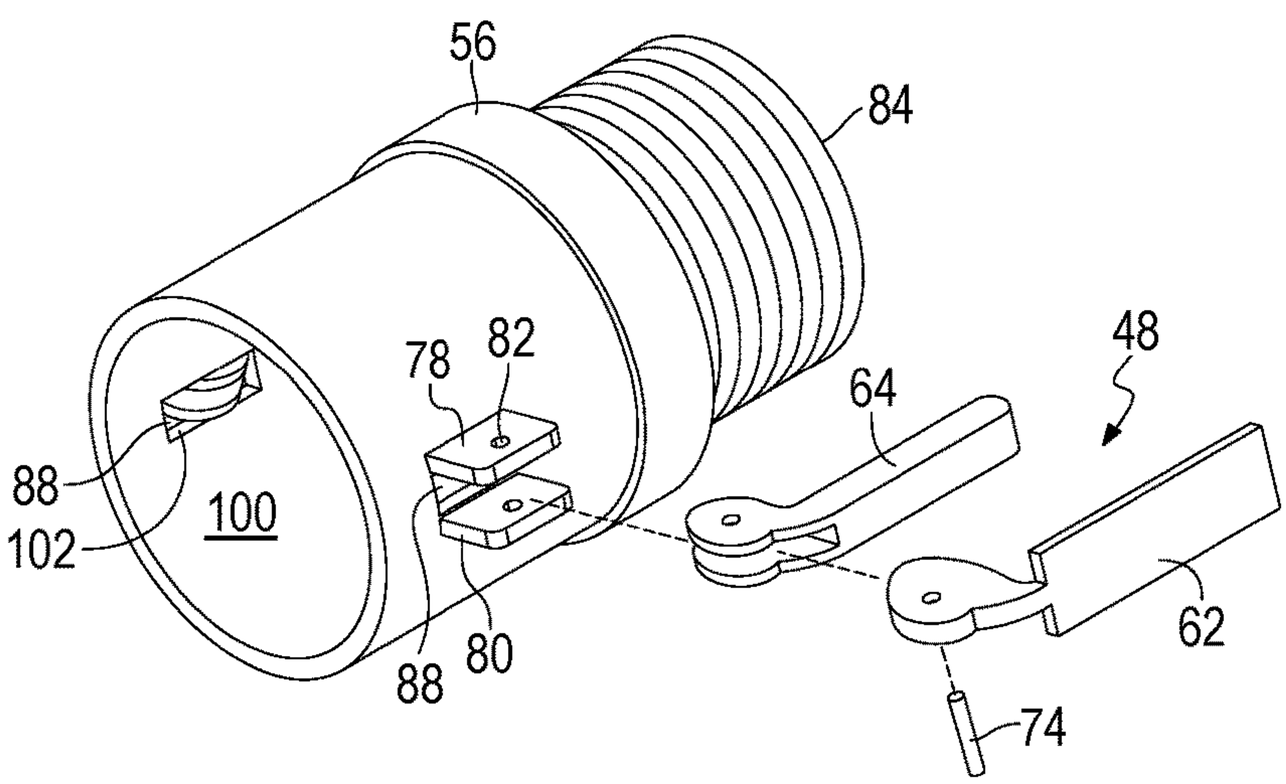


FIG. 4

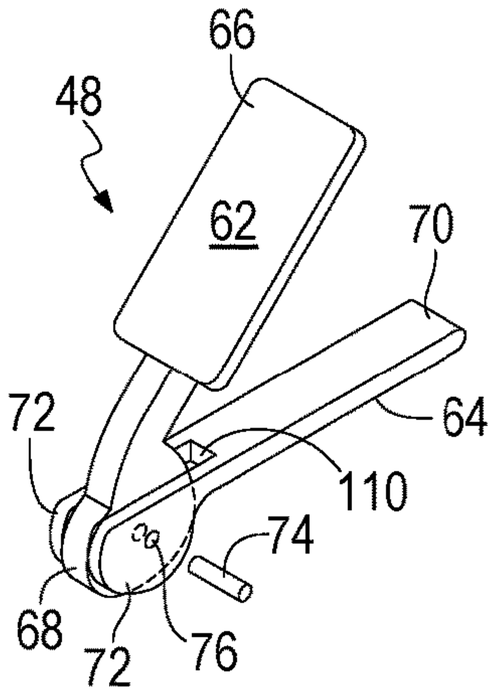


FIG. 5

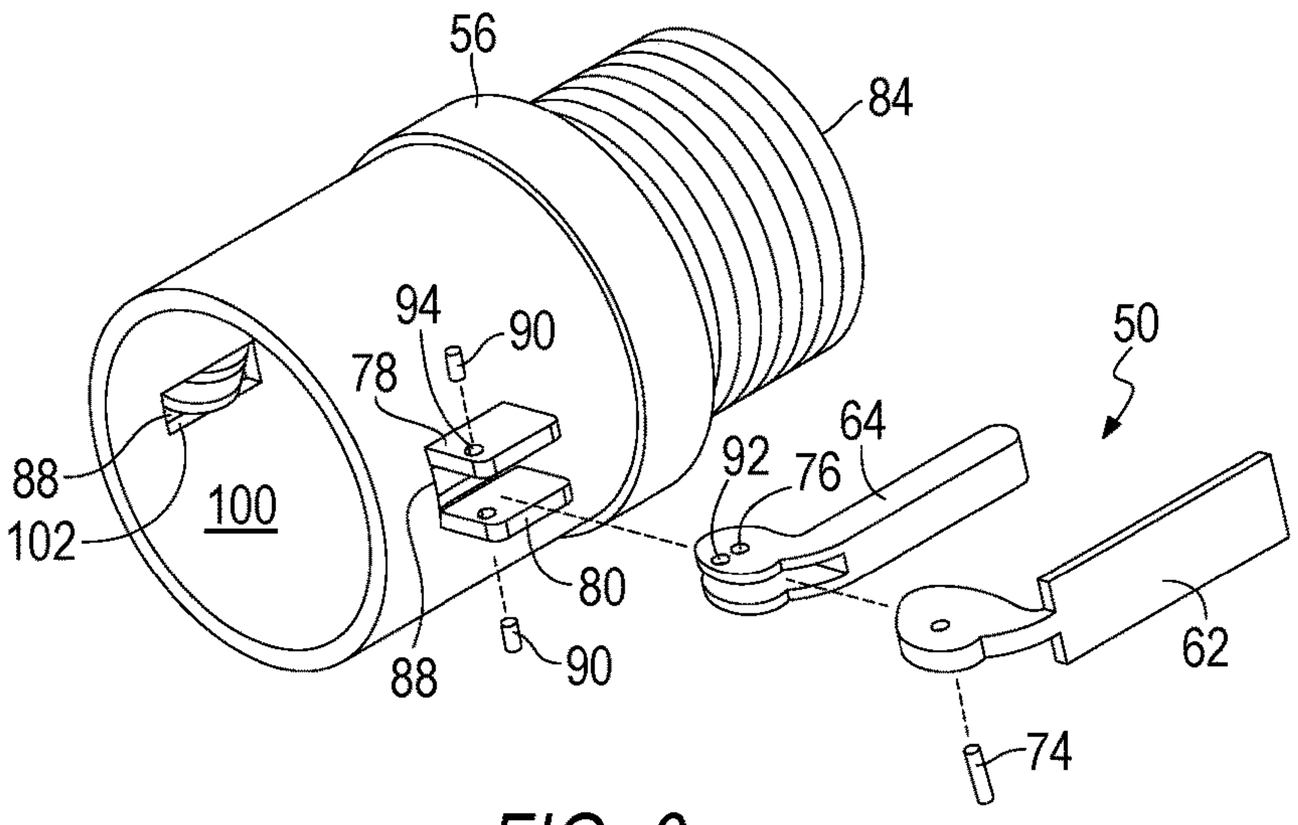


FIG. 6

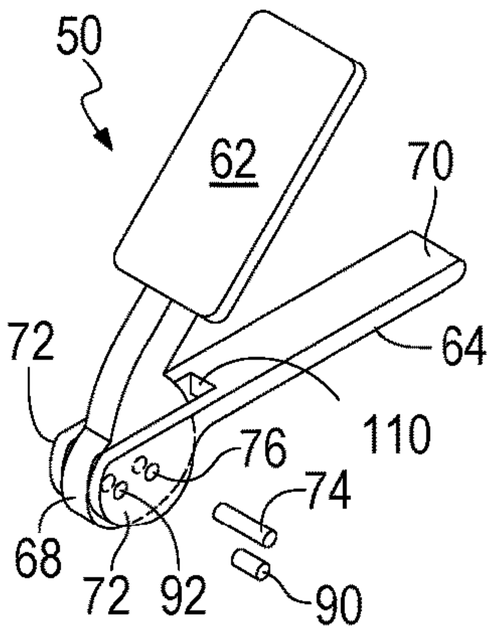
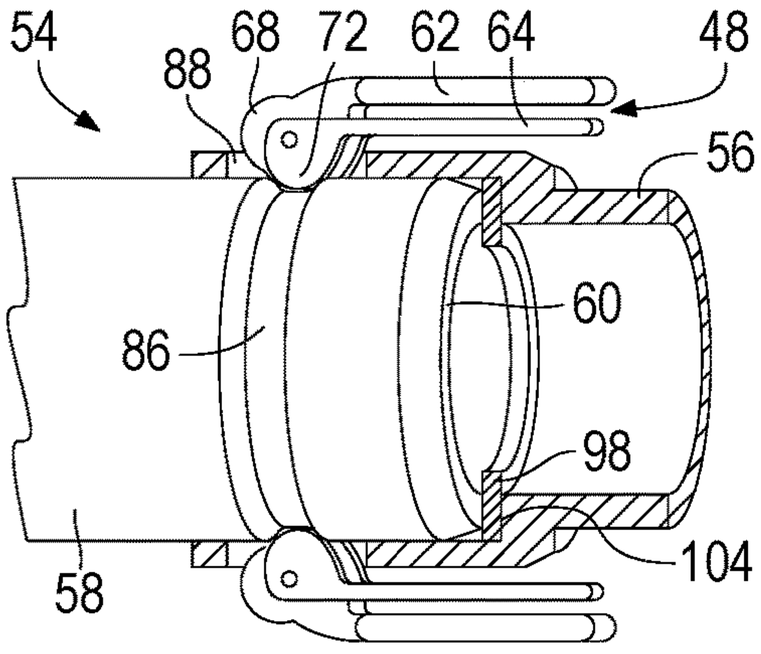


FIG. 7



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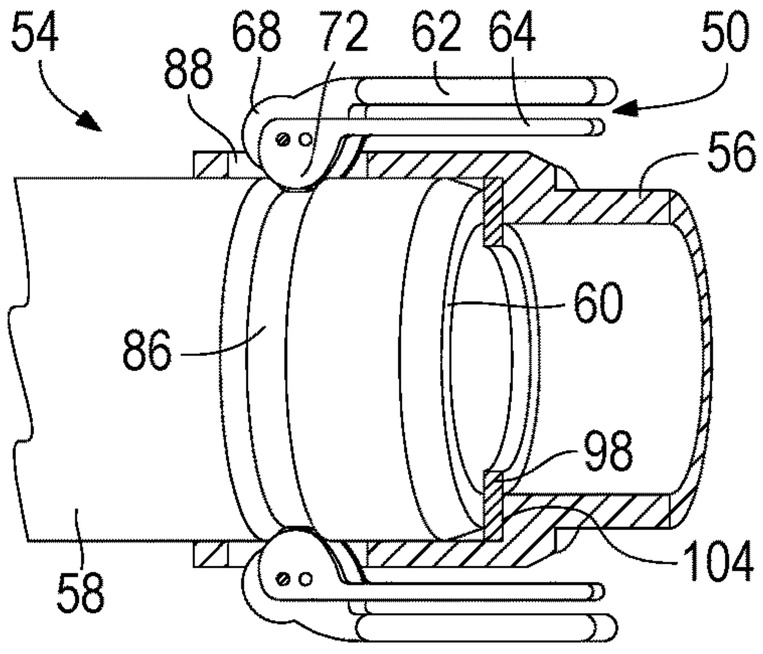

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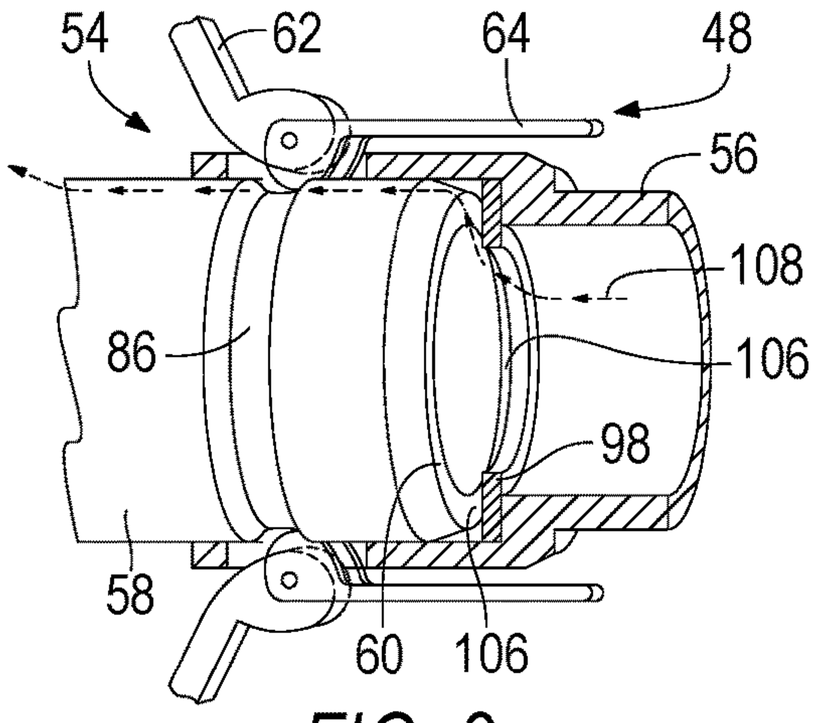


FIG. 9

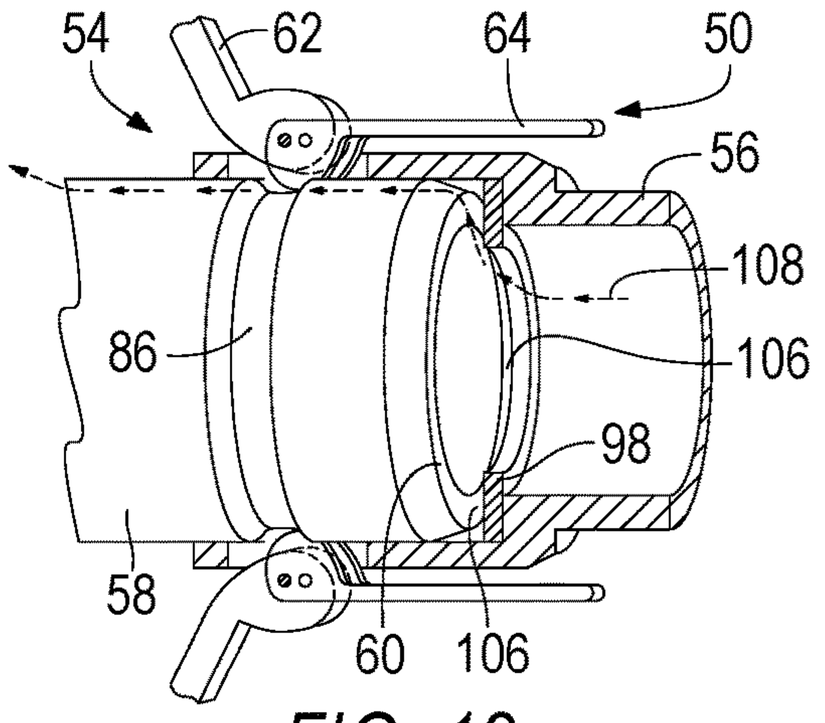


FIG. 12

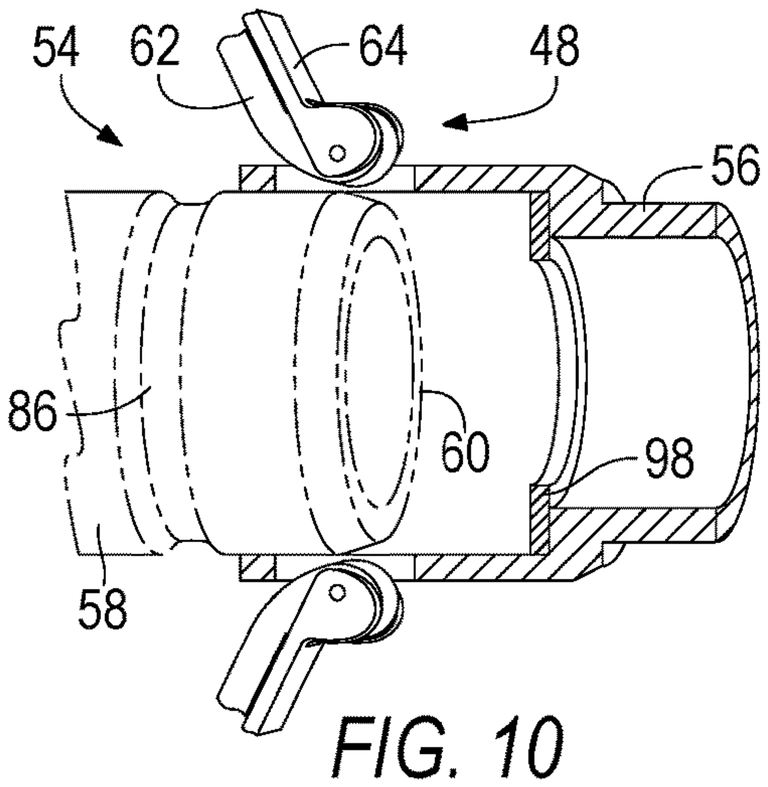


FIG. 10

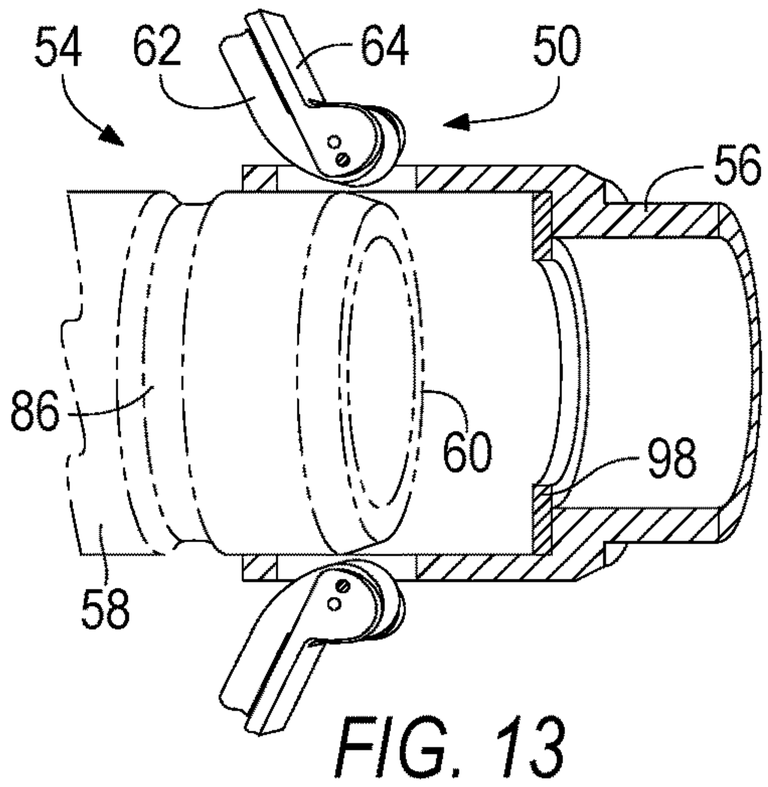


FIG. 13

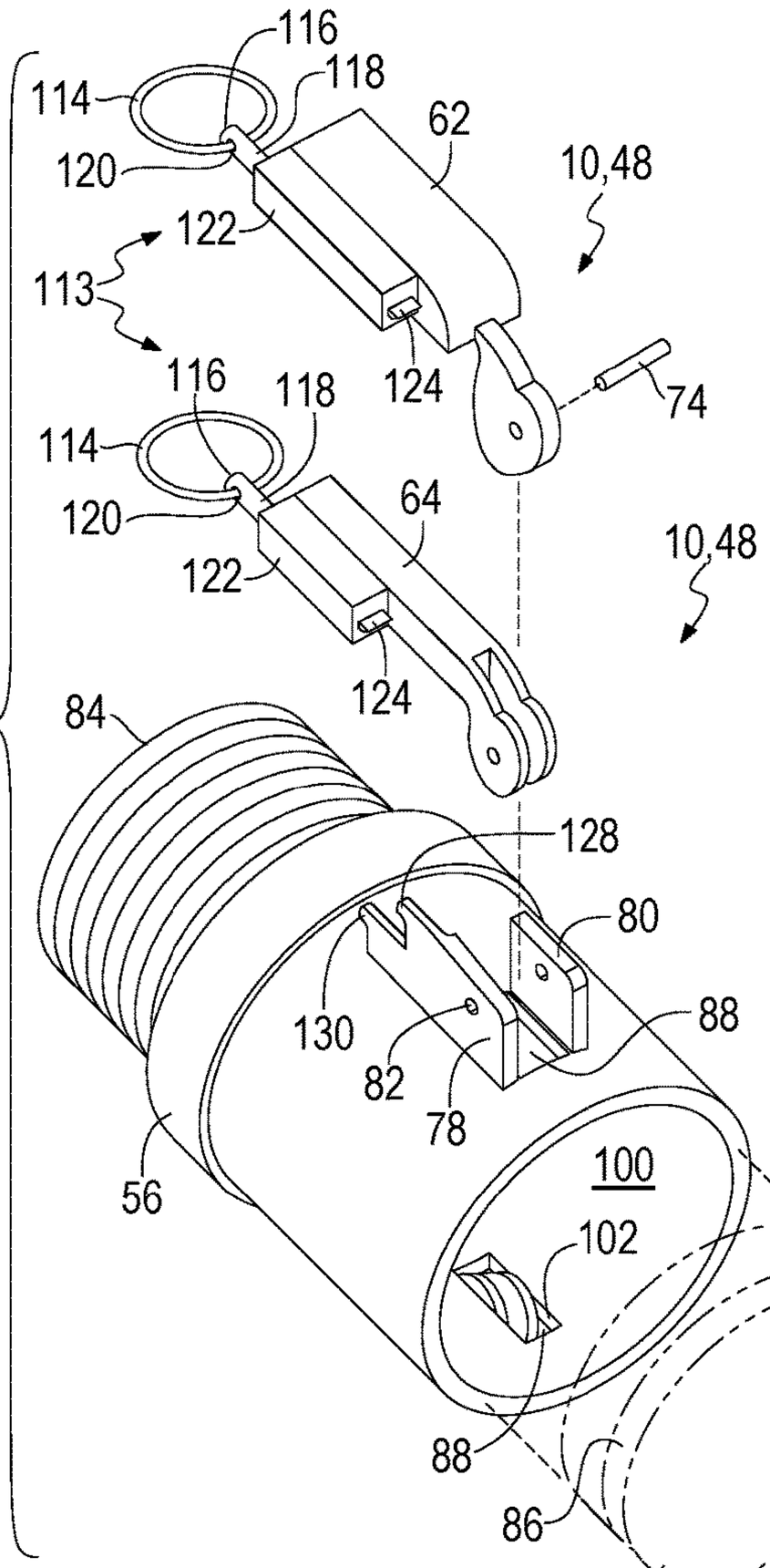


FIG. 20

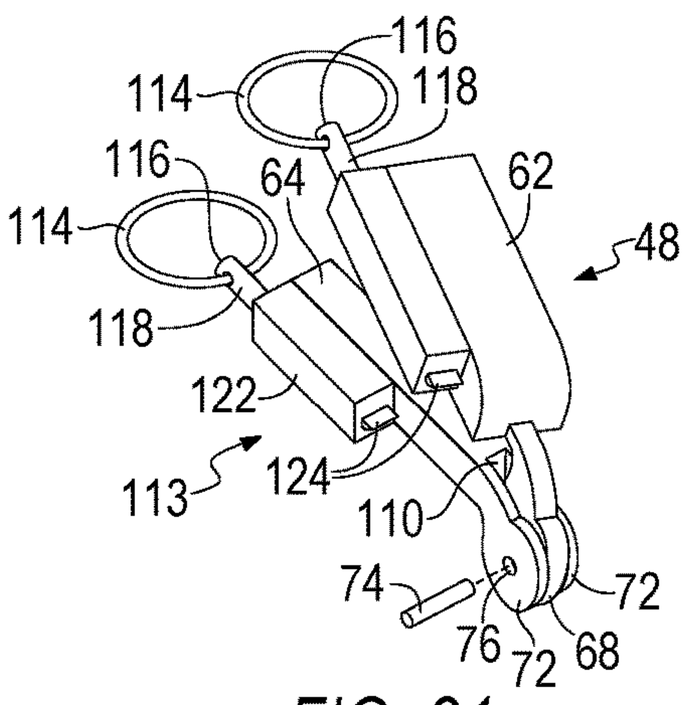


FIG. 21

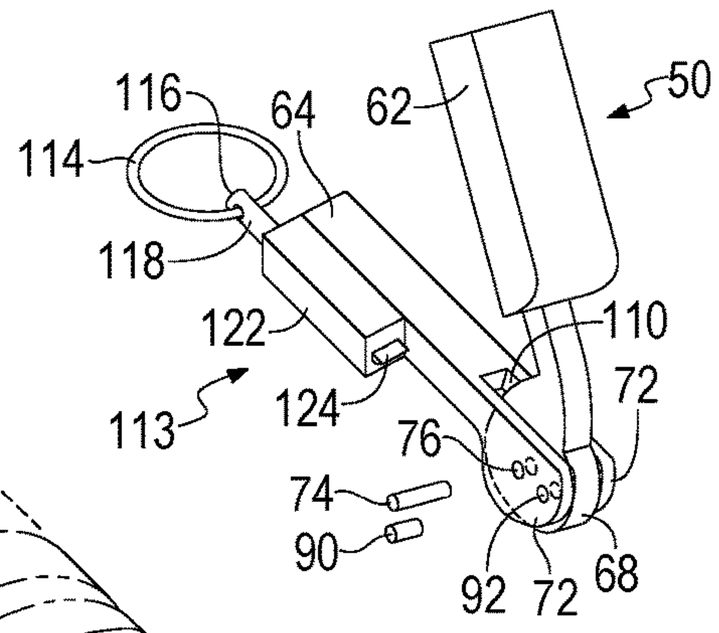
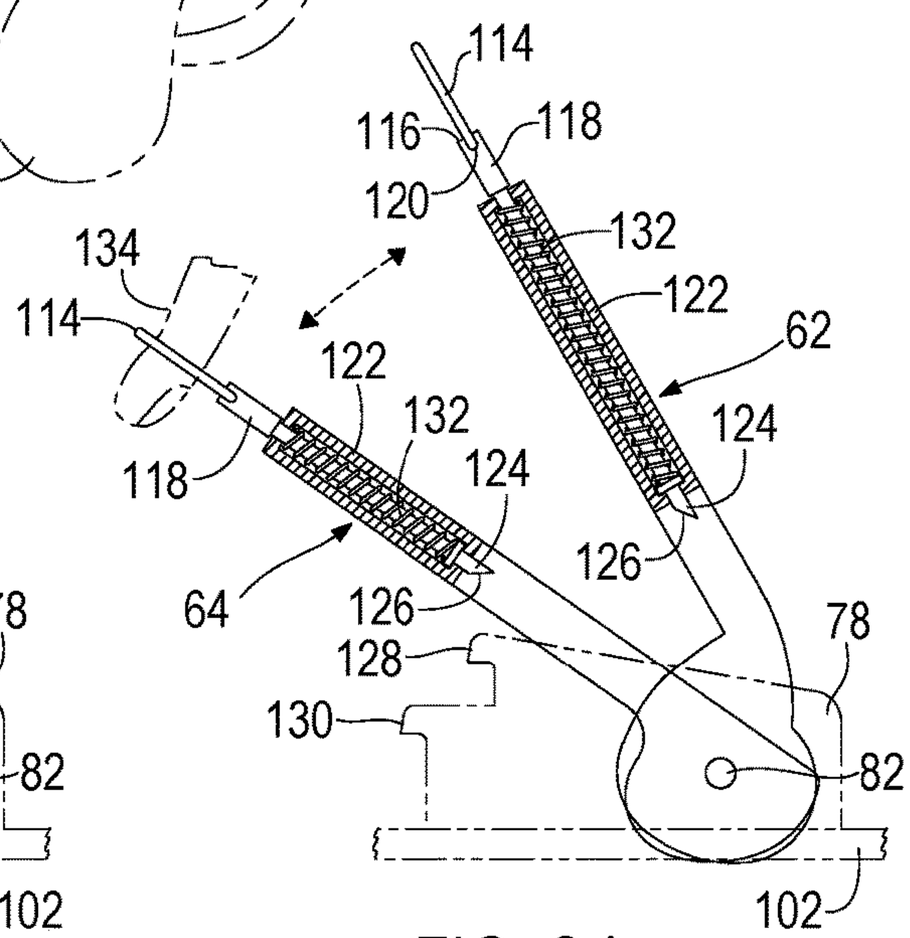


FIG. 22



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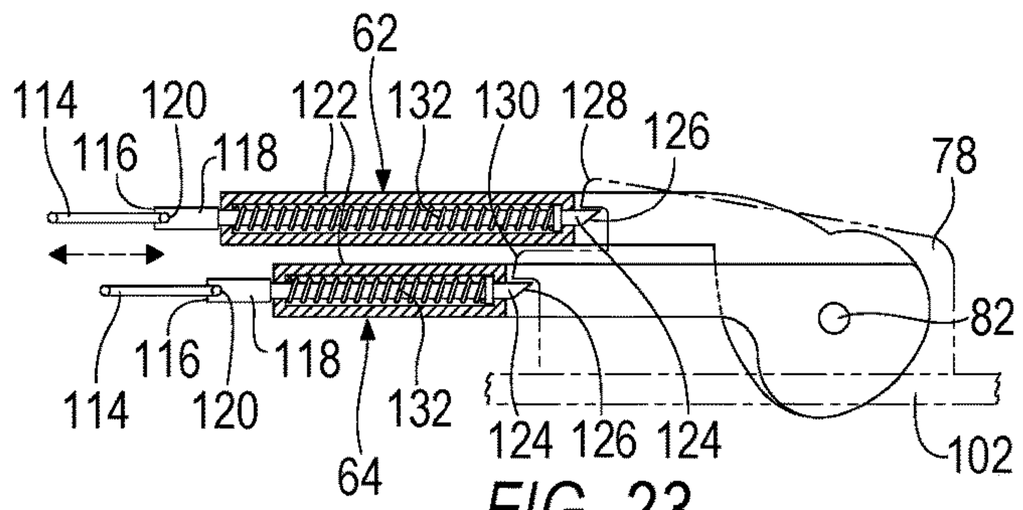

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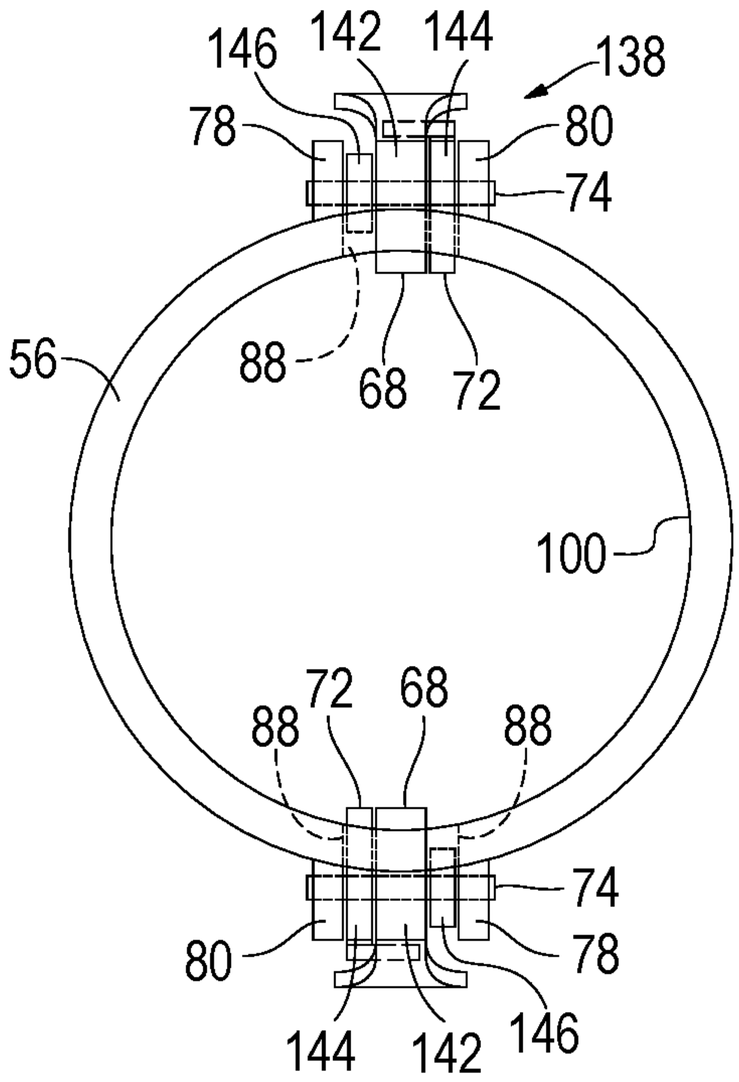
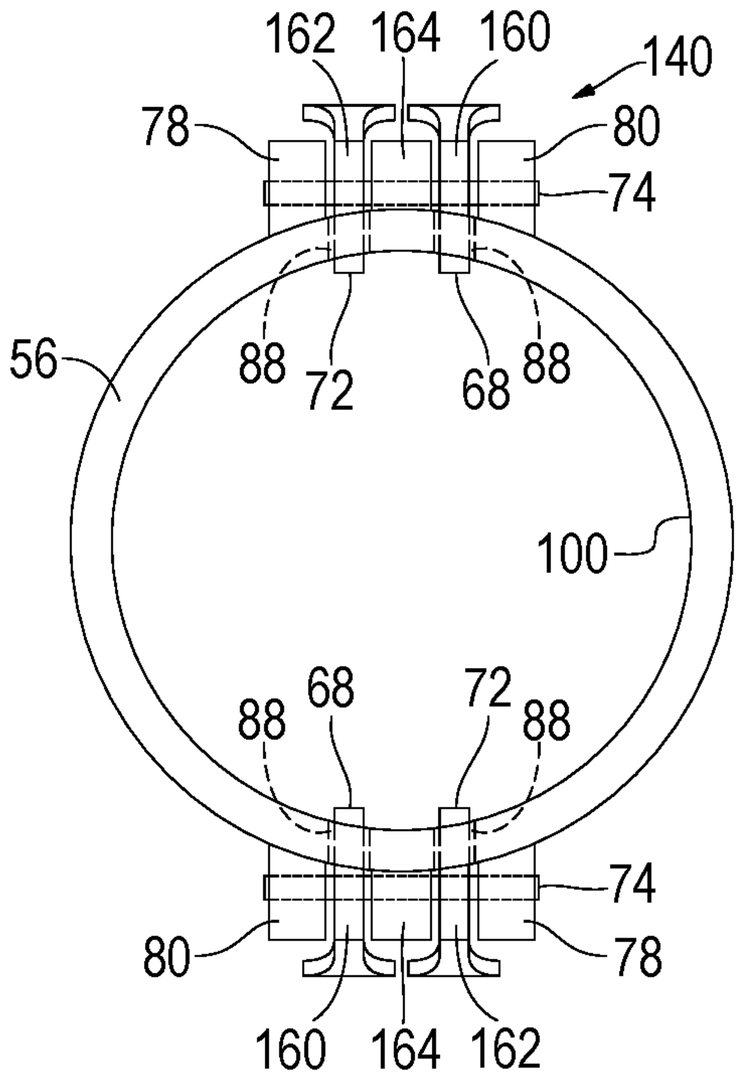


FIG. 26



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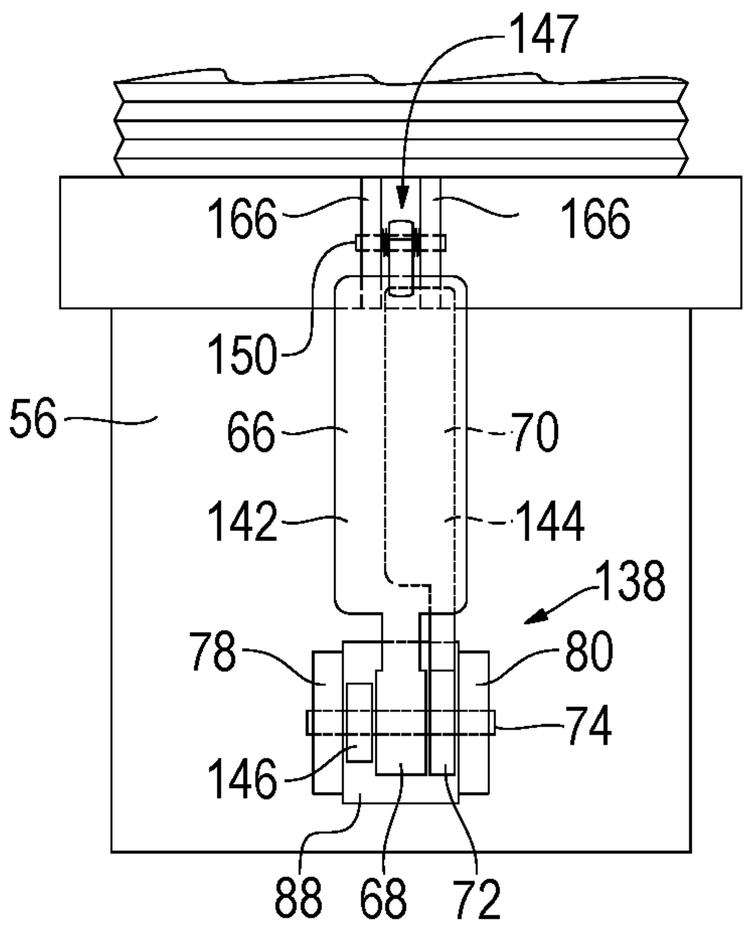

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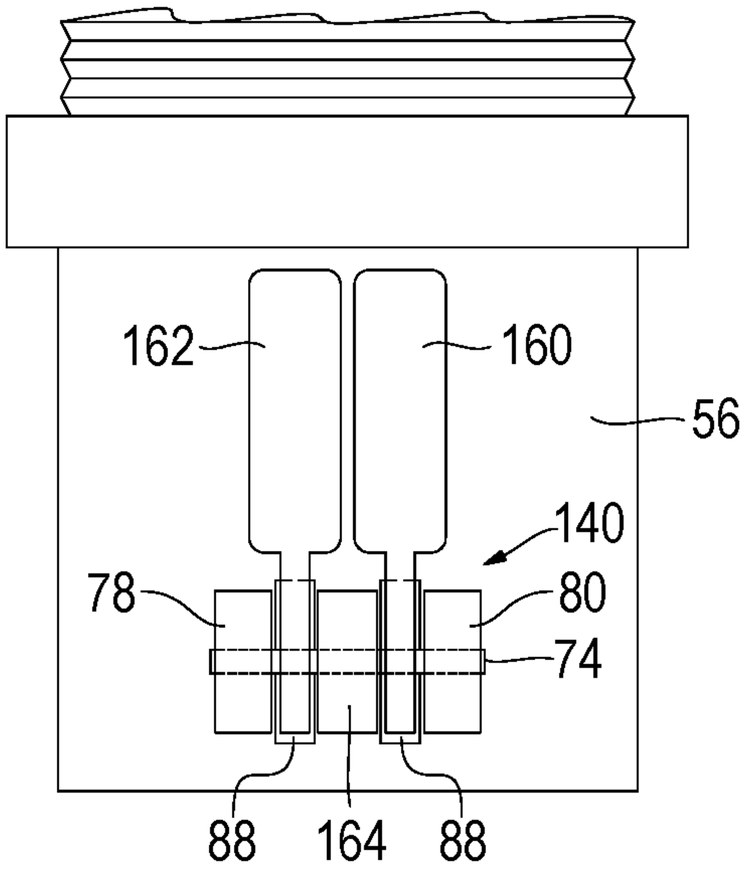
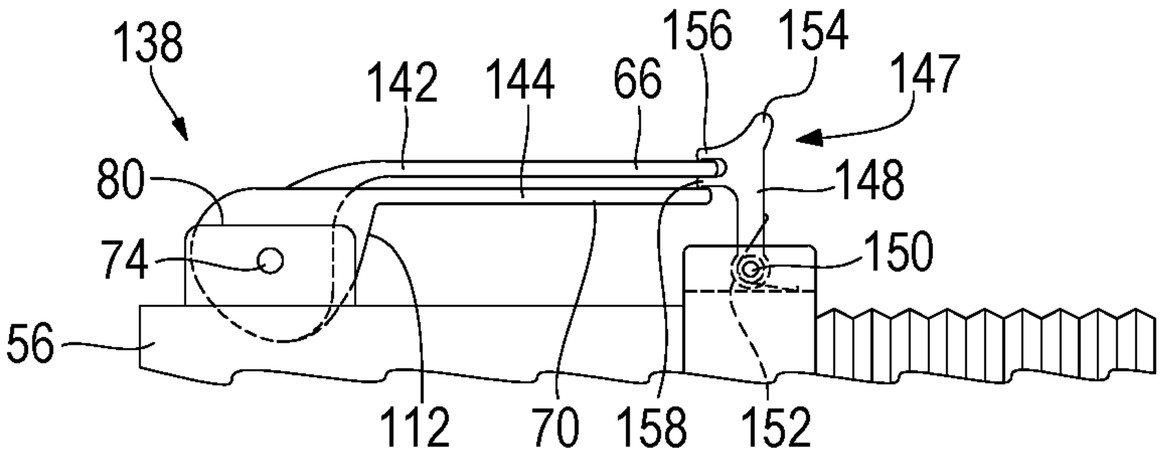


FIG. 29

FIG. 30



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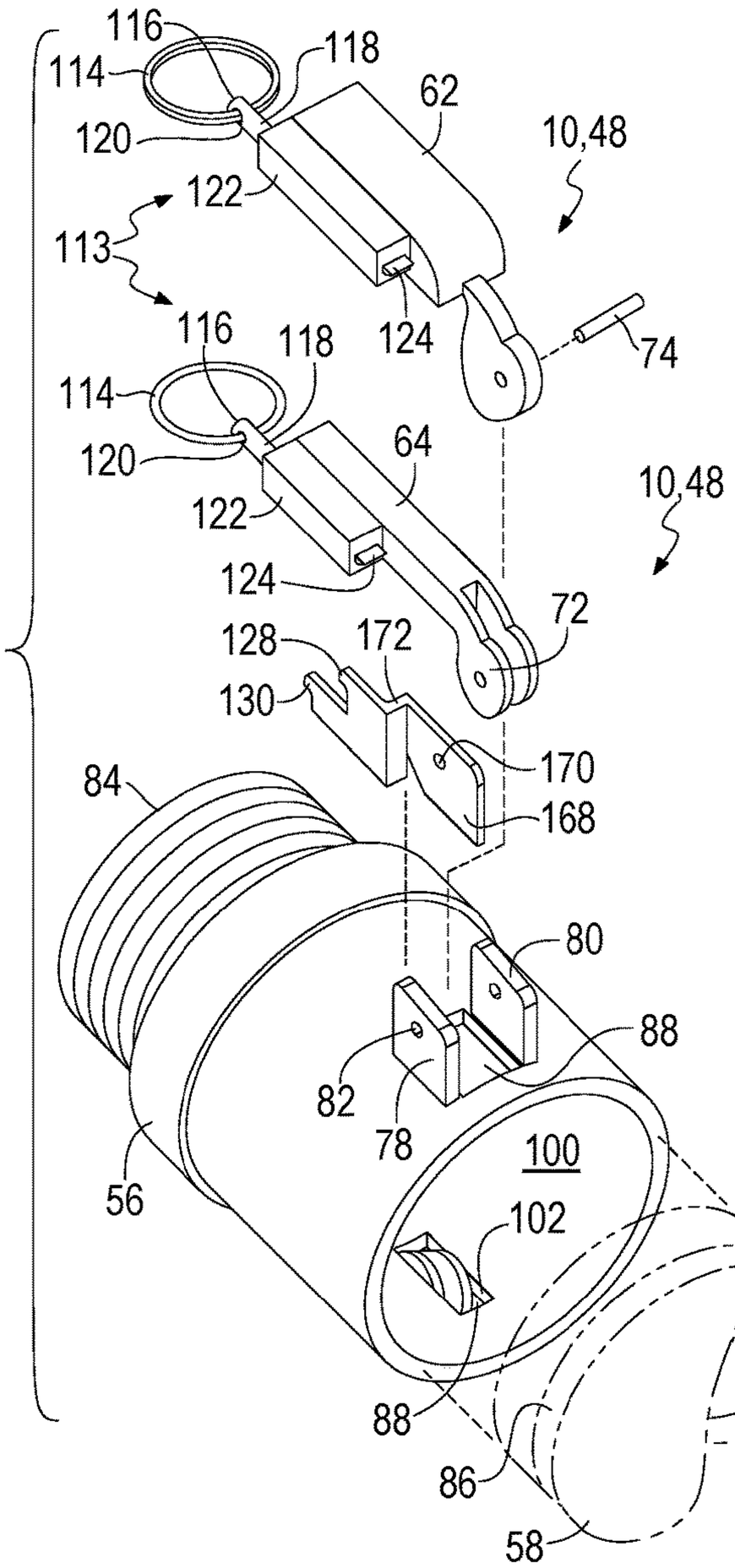

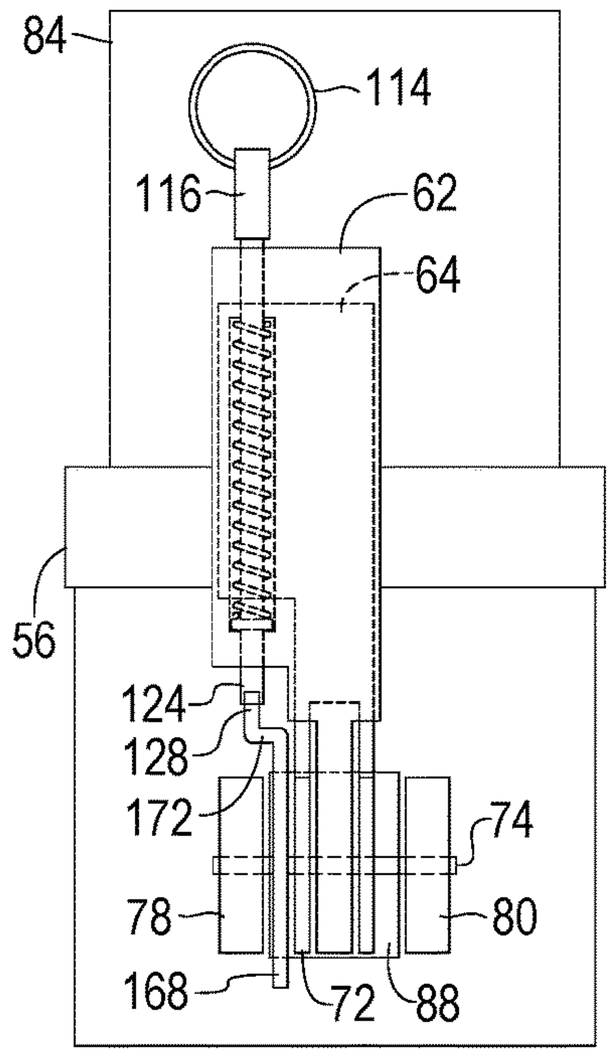

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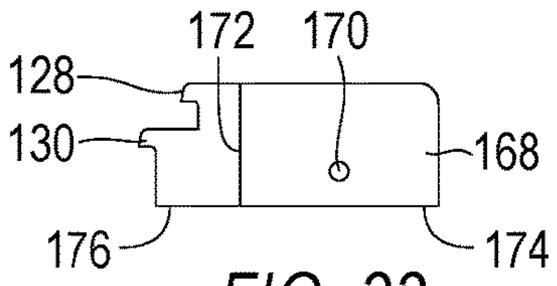


FIG. 33

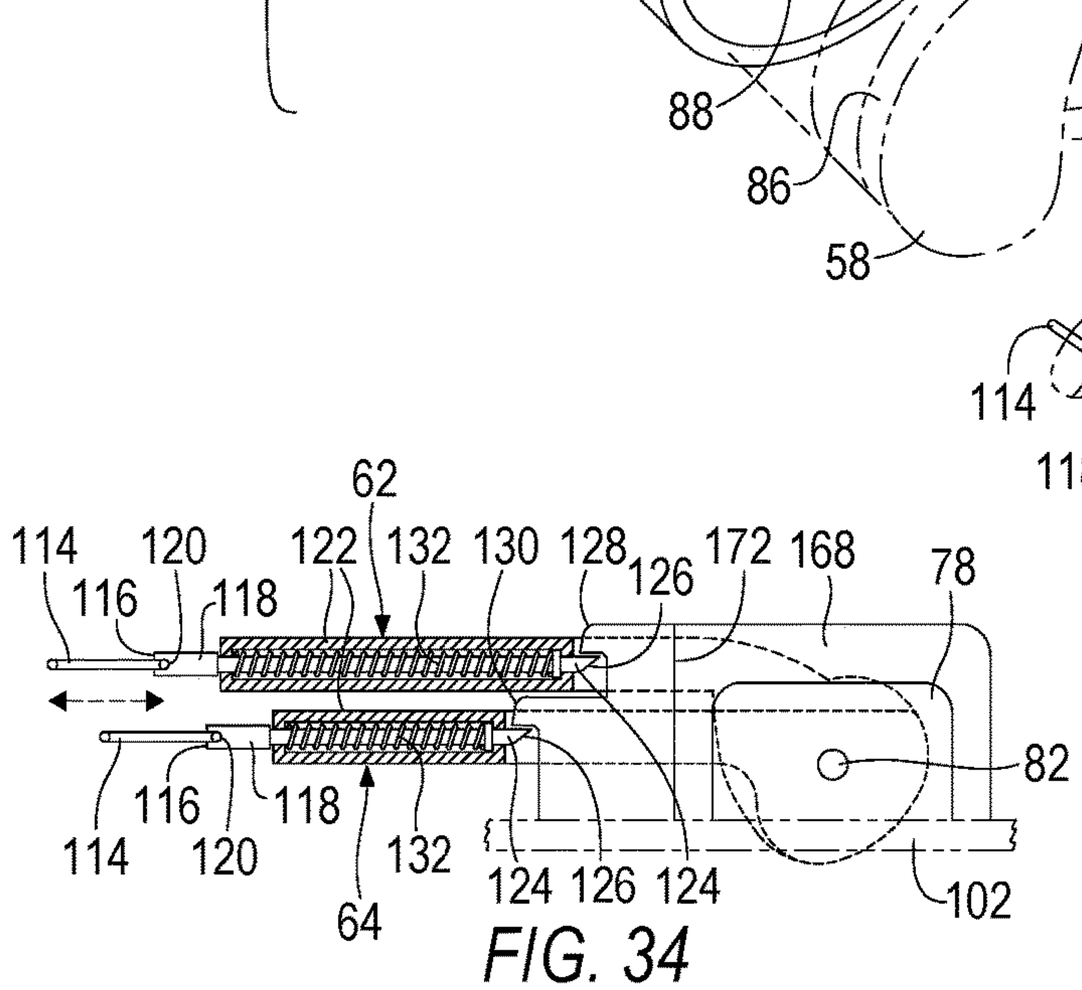


FIG. 34

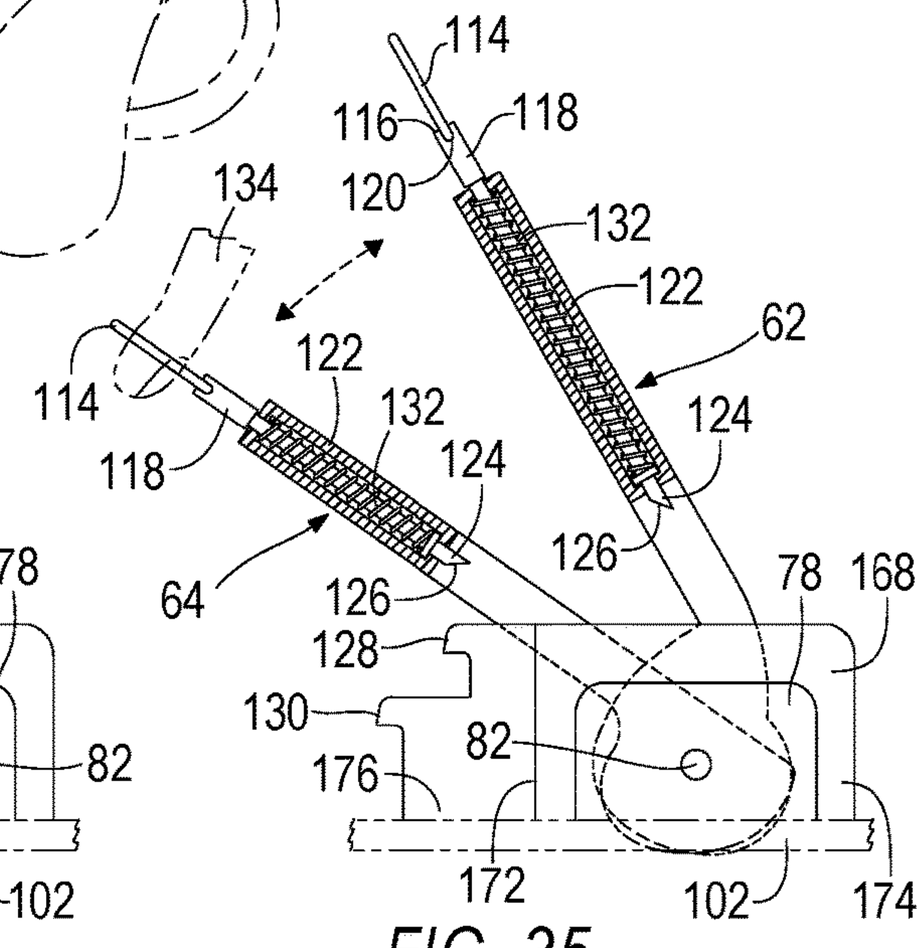
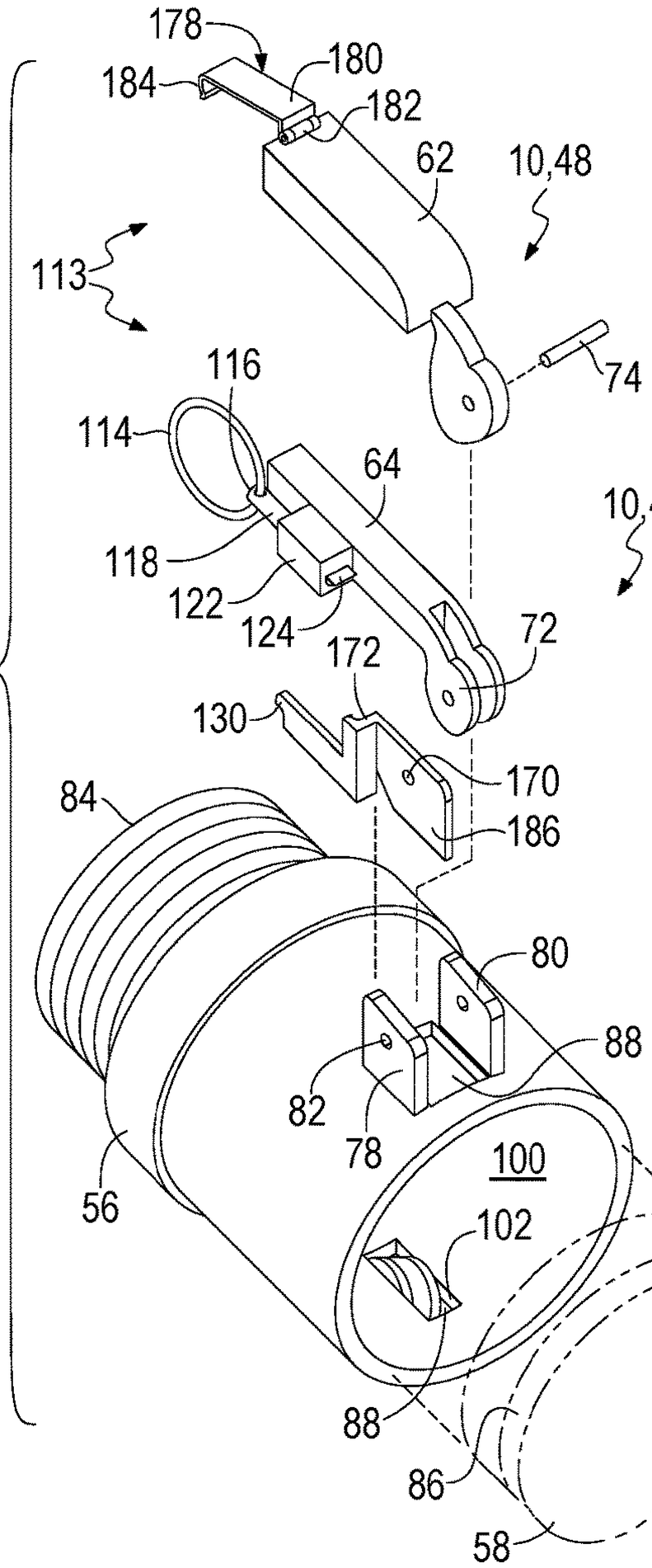


FIG. 35

FIG. 36



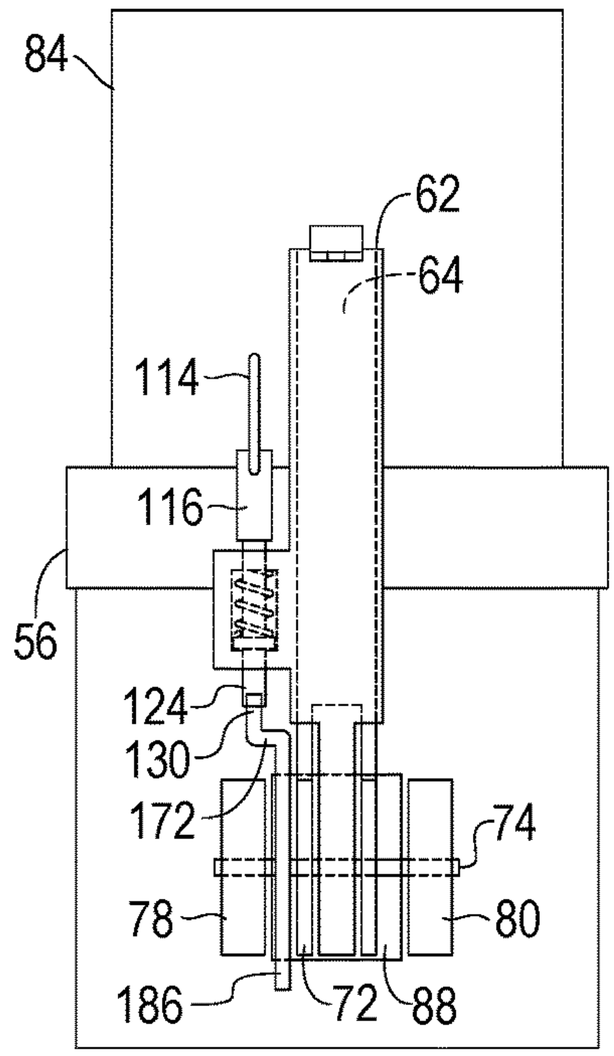


FIG. 37

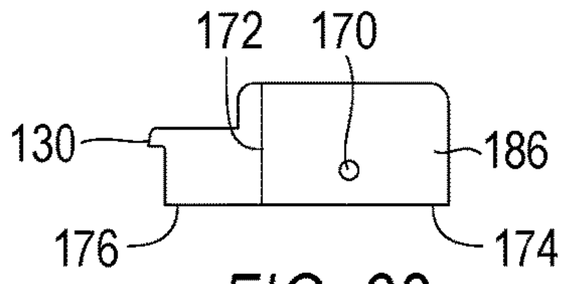
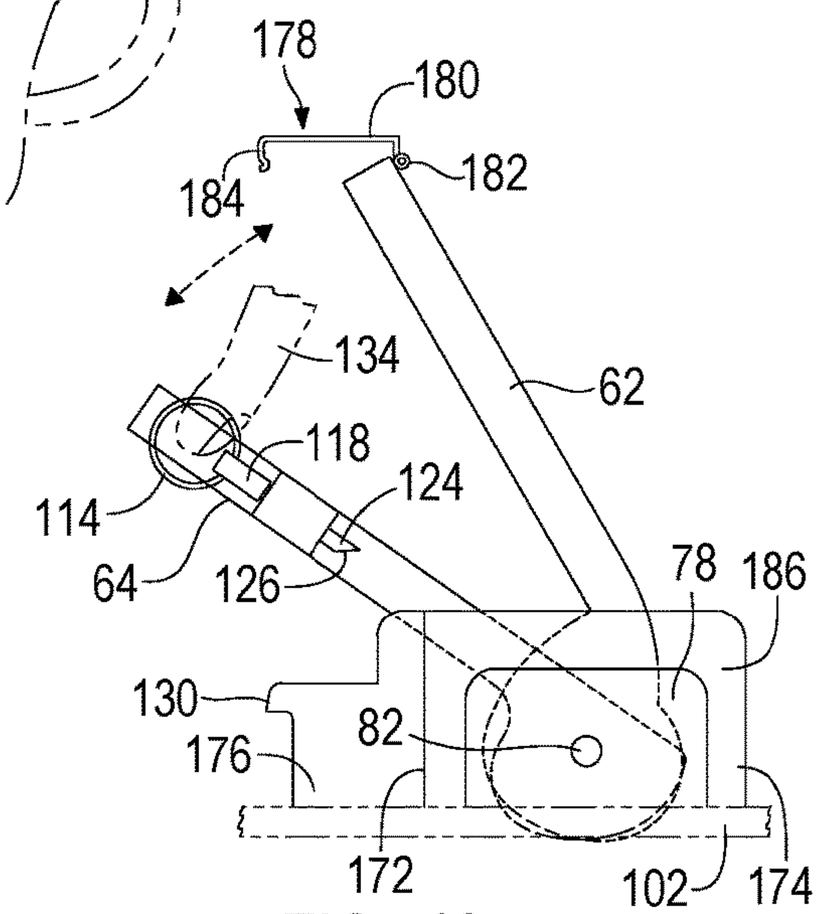


FIG. 38

FIG. 39



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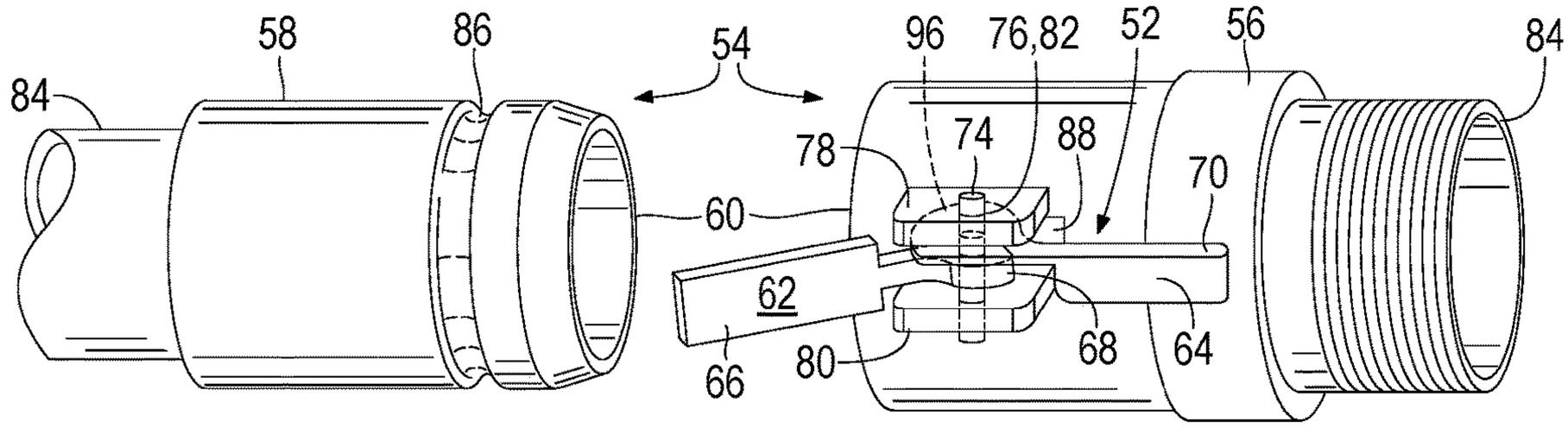


FIG. 41

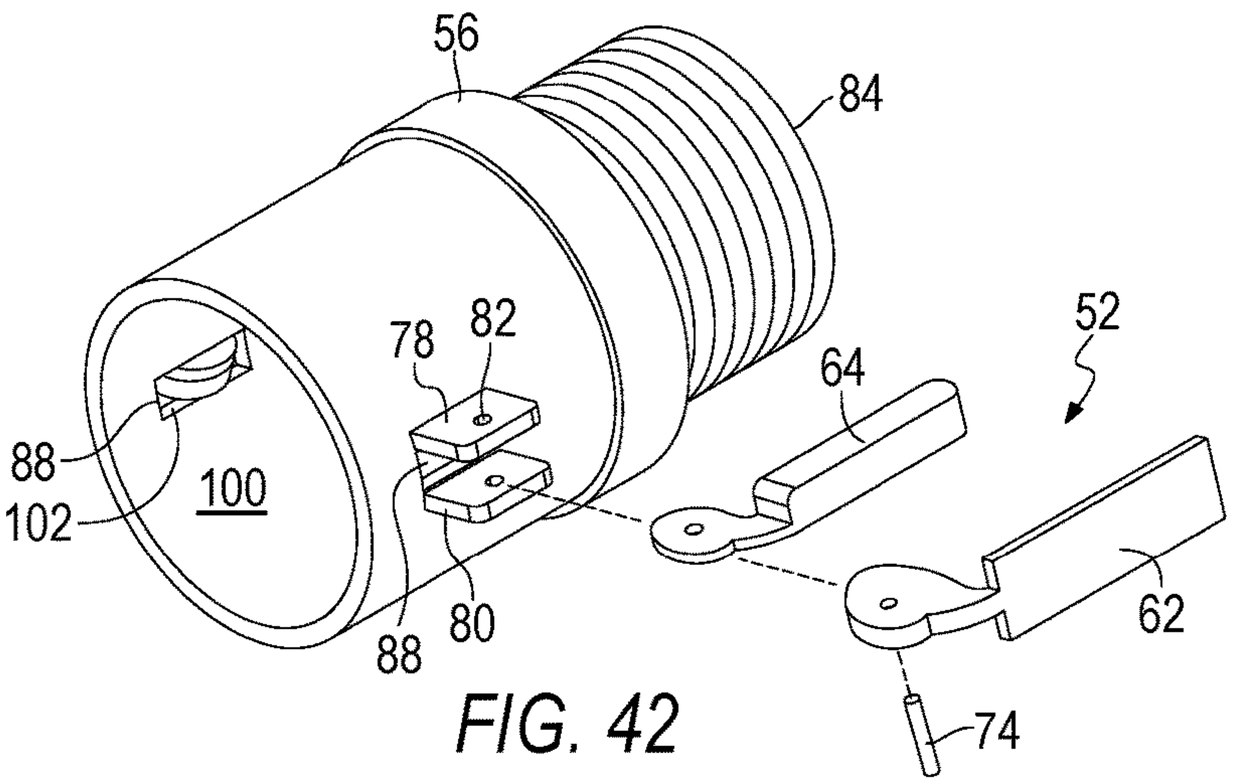


FIG. 42

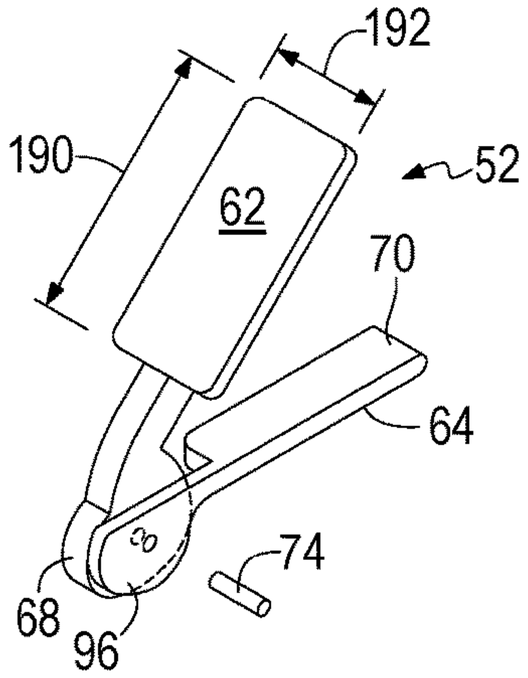


FIG. 43

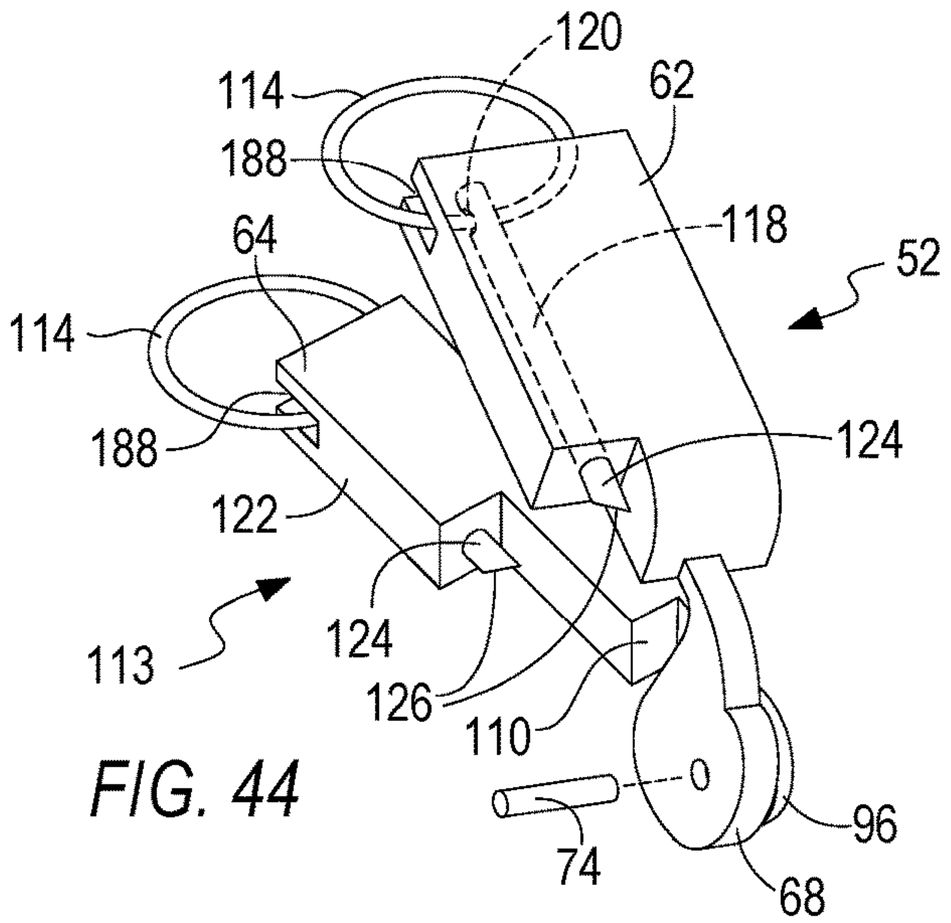


FIG. 44

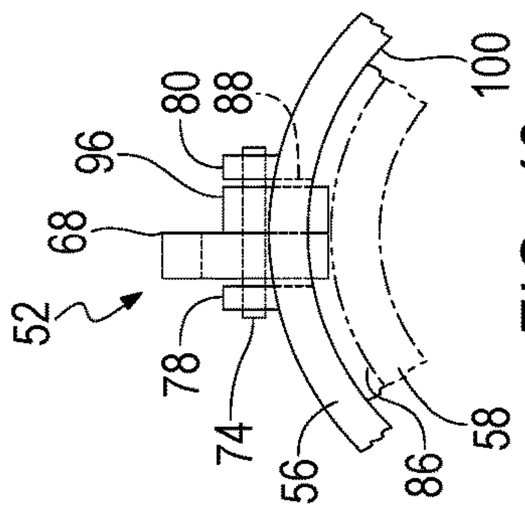


FIG. 48

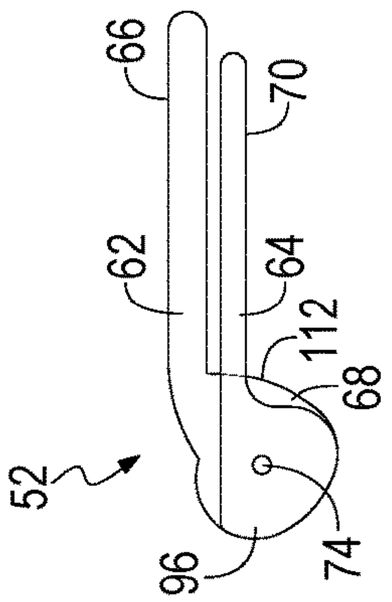


FIG. 49

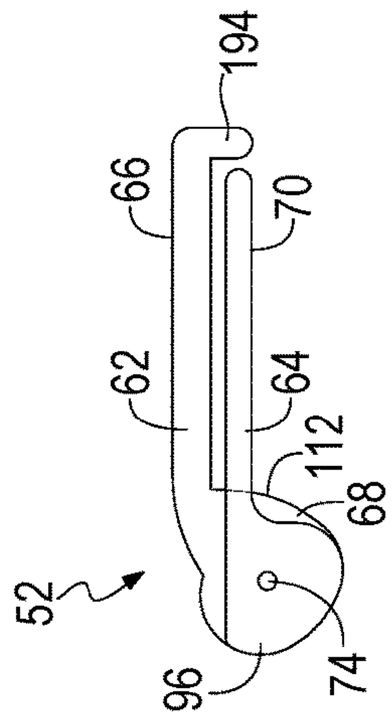


FIG. 50

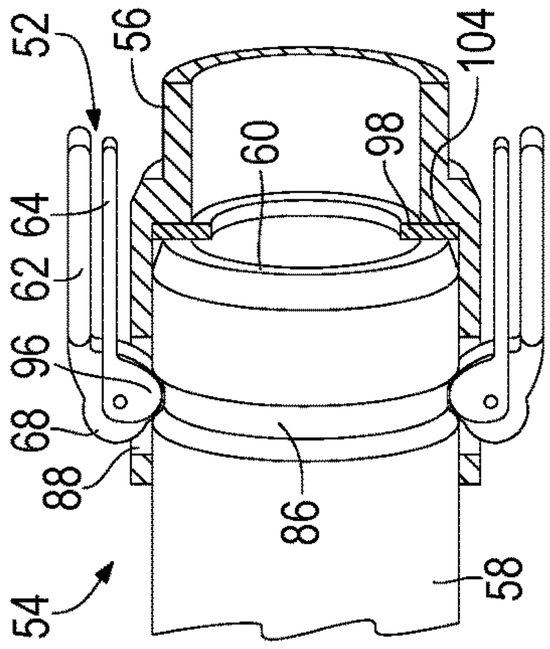


FIG. 45

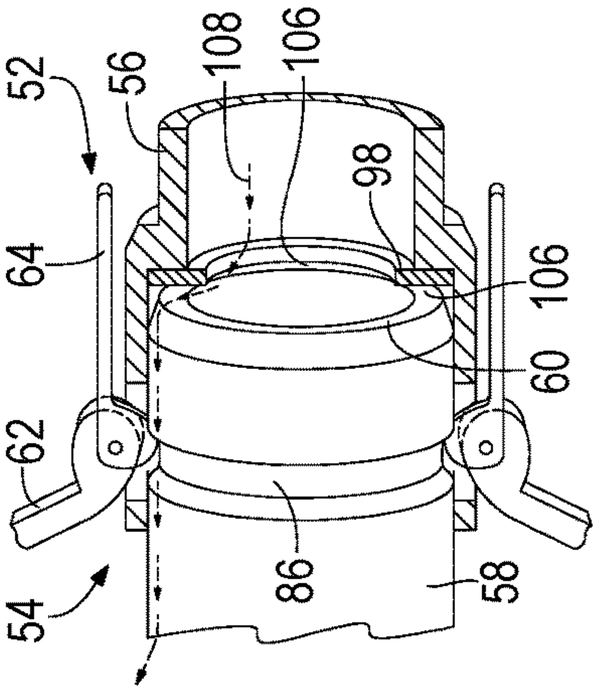


FIG. 46

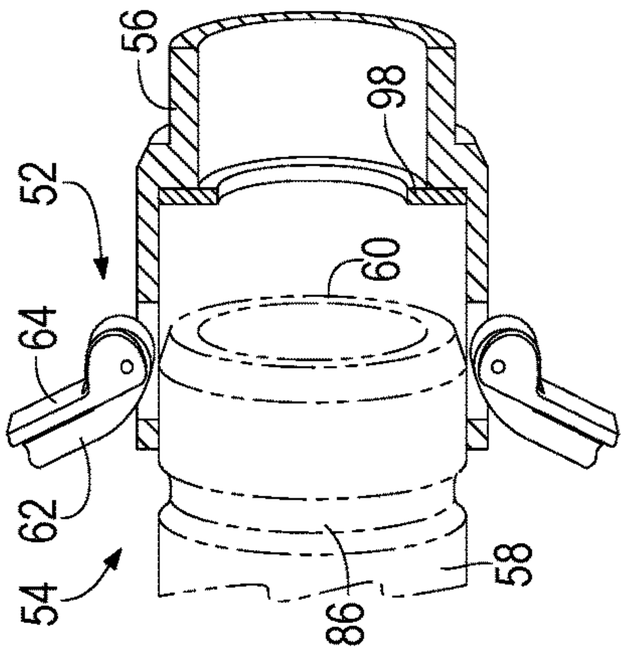


FIG. 47

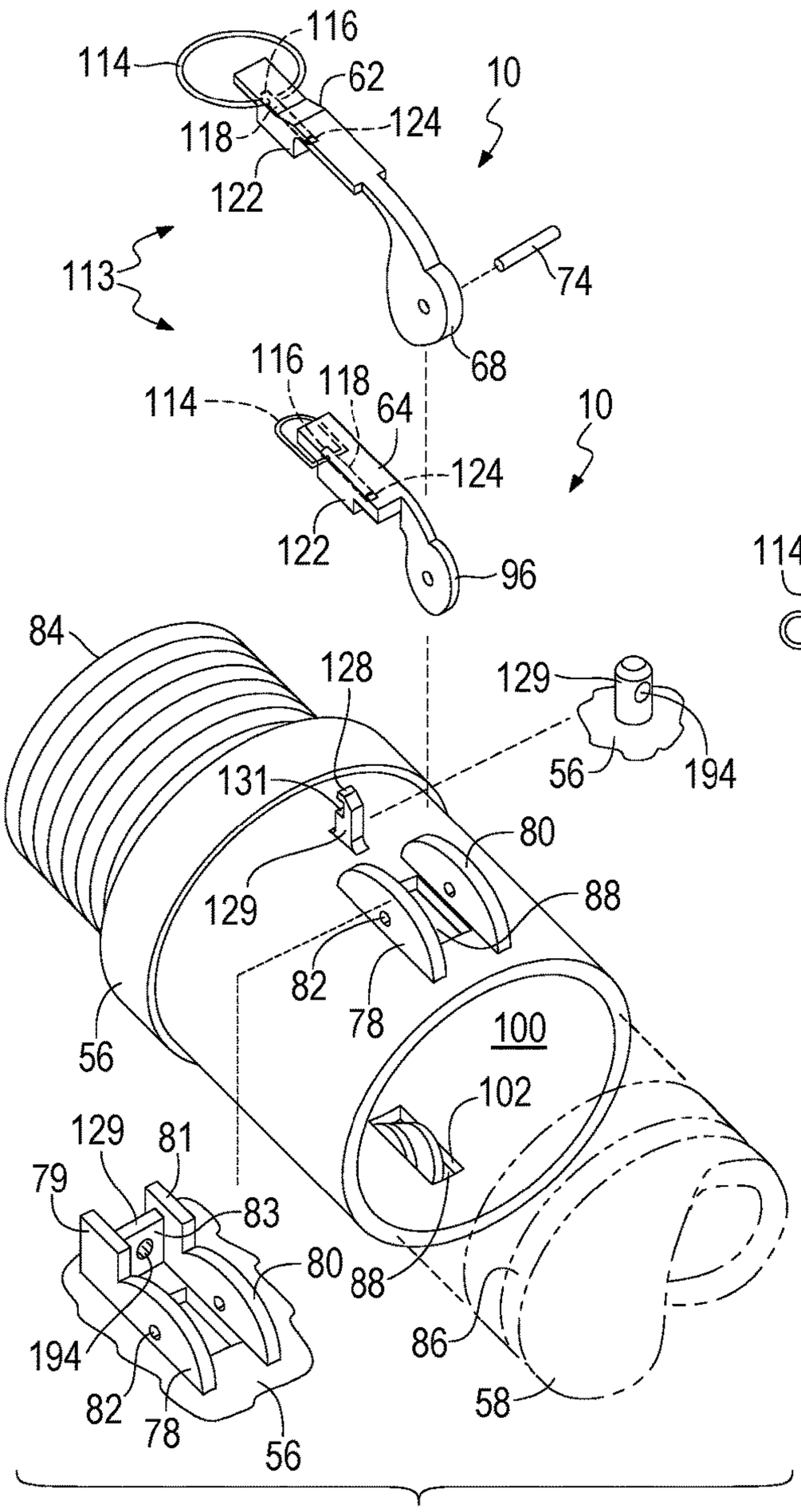


FIG. 51

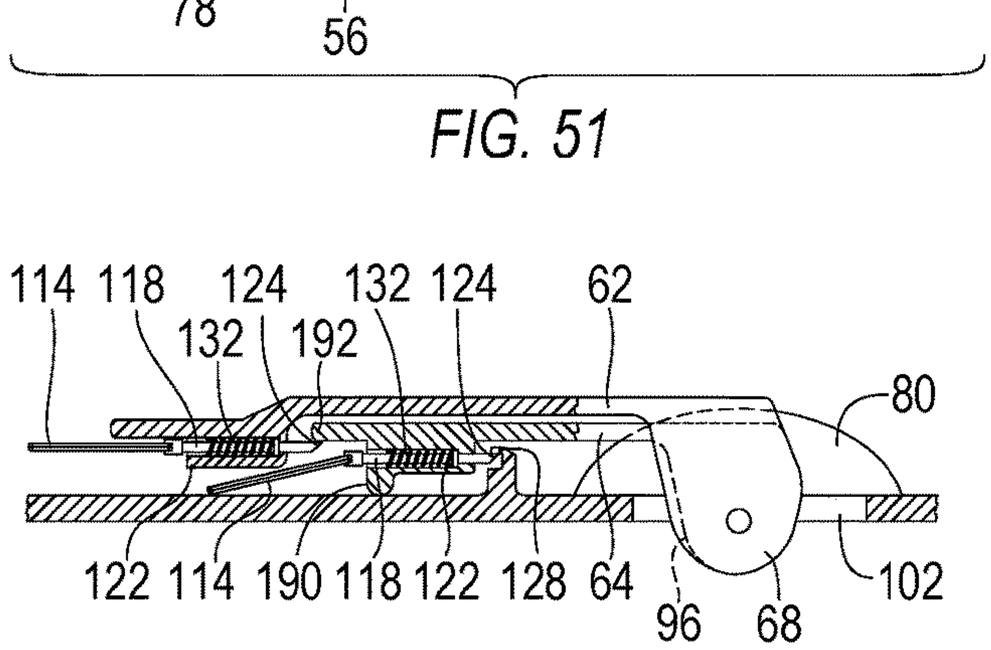


FIG. 55

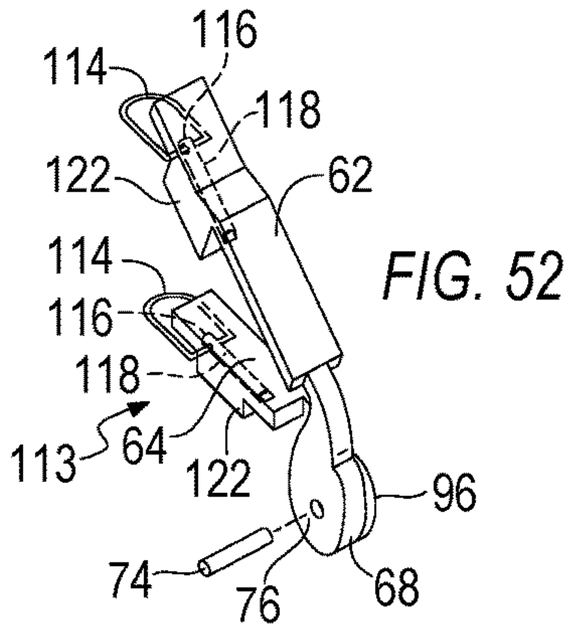


FIG. 52

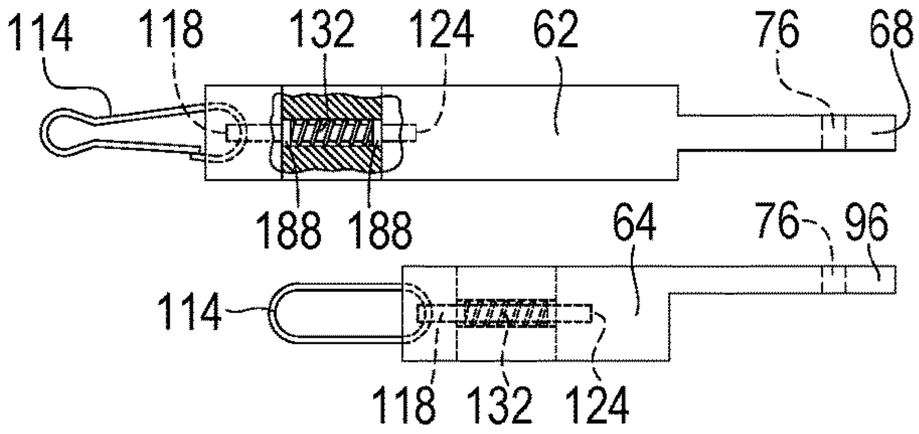


FIG. 53

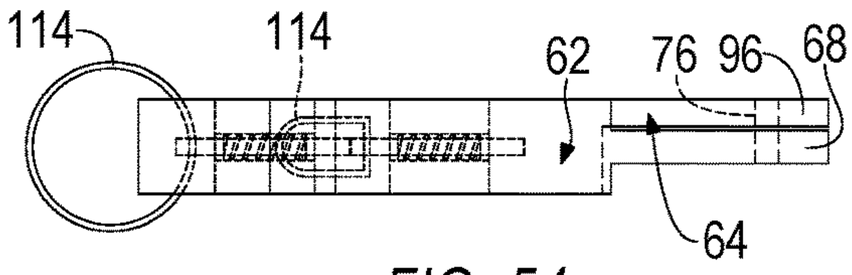


FIG. 54

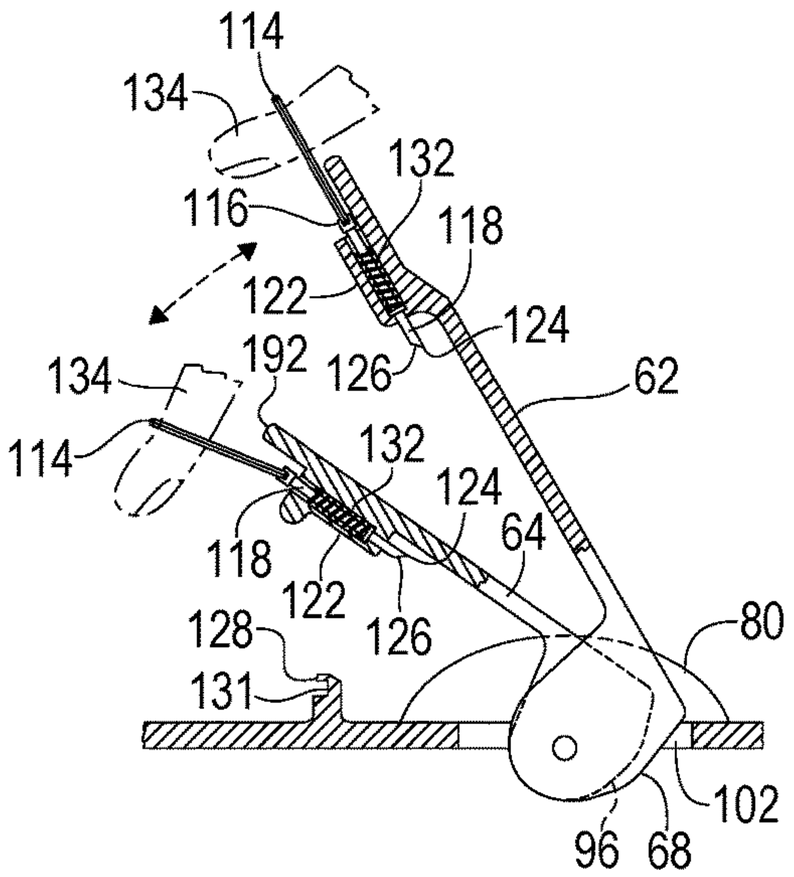


FIG. 56

FIG. 57

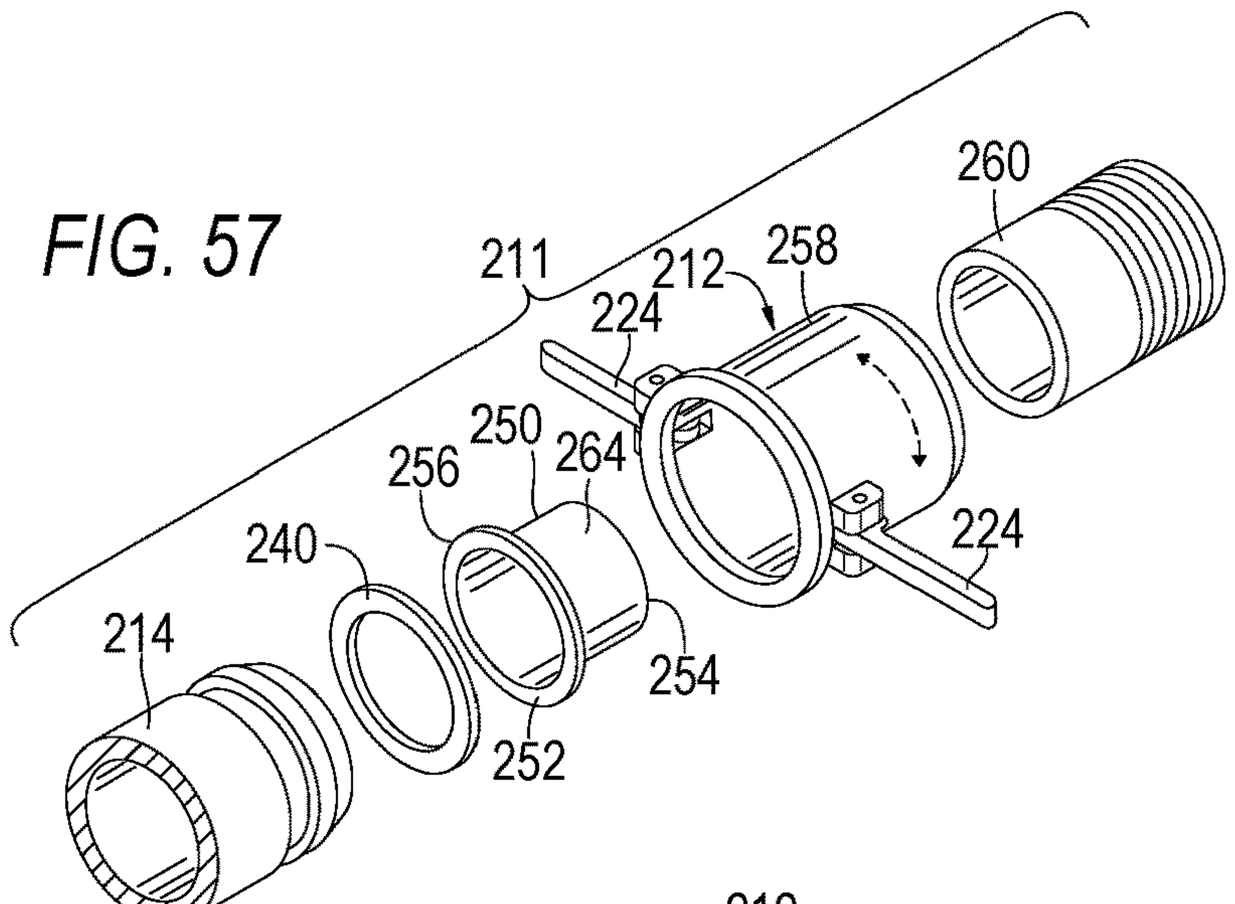


FIG. 58

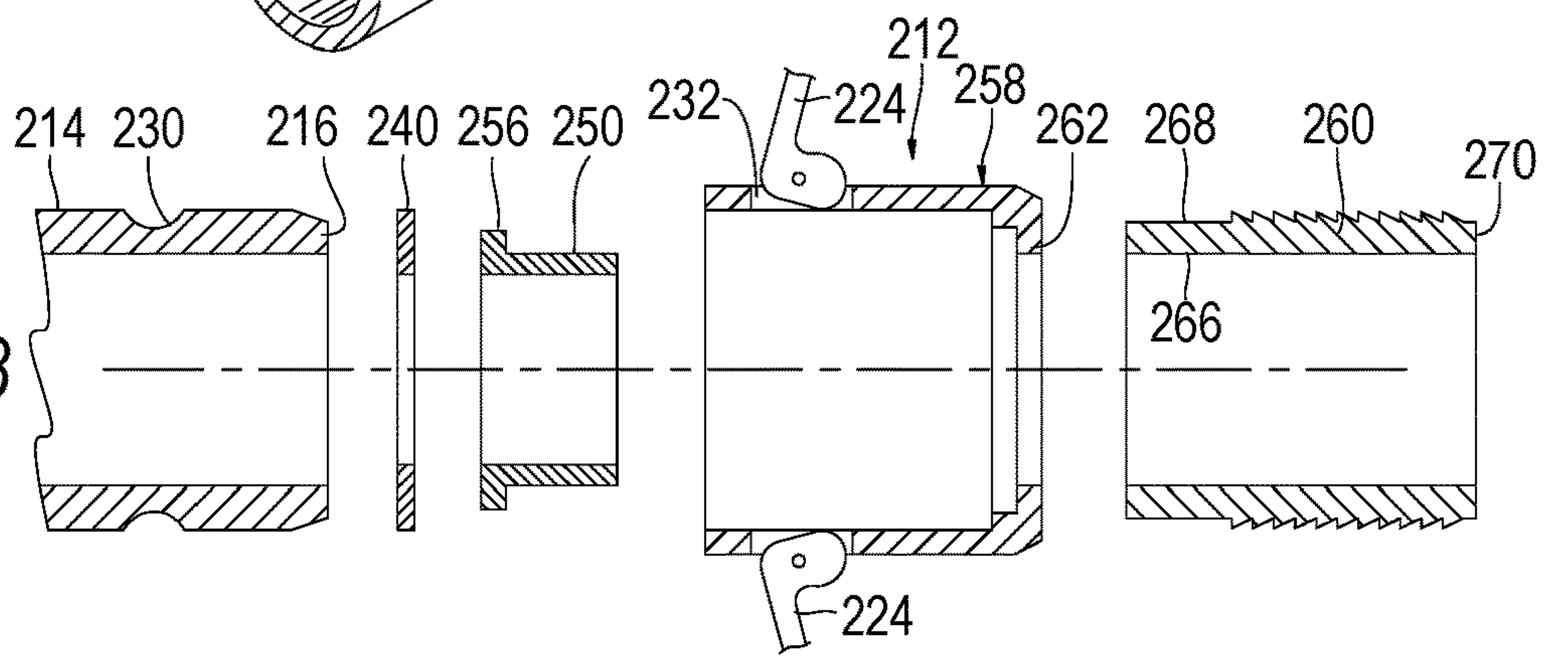


FIG. 59

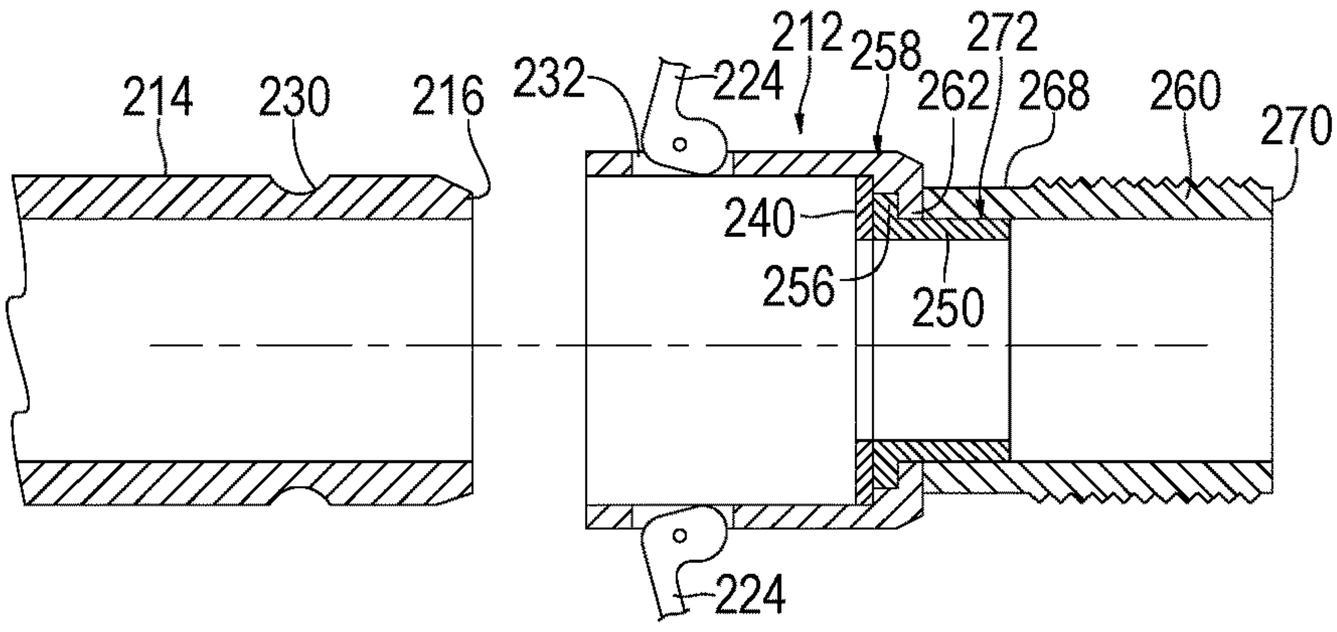
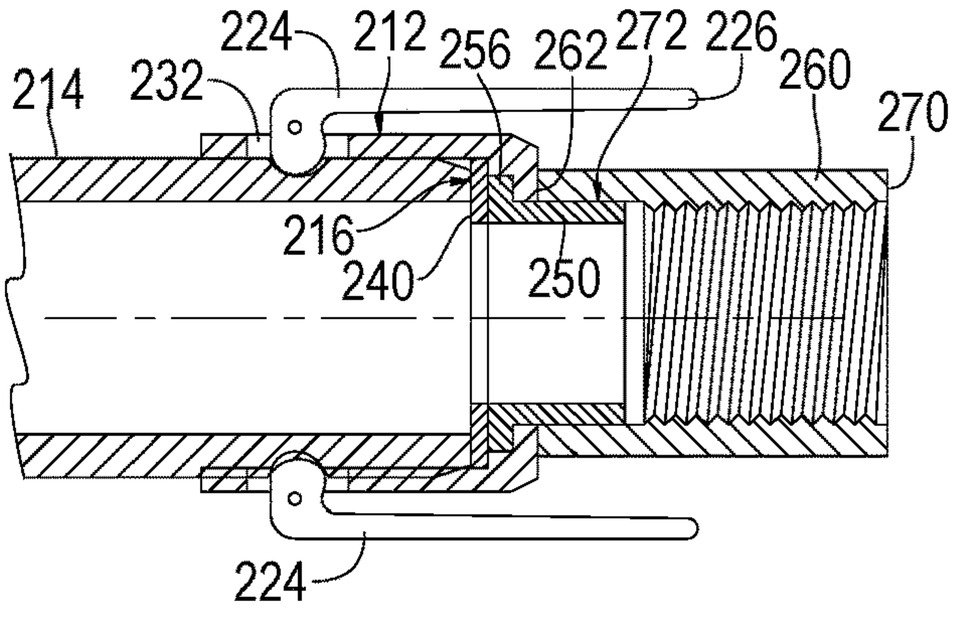


FIG. 60



ROTATING FEMALE PORTION AND ERGONOMIC SAFETY LOCK FOR CAM LOCK FITTING

RELATED APPLICATIONS

This application is a continuation-in-part of U.S. patent application Ser. No. 16/517,379 filed Jul. 19, 2019.

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates generally to cam lock fittings and, more particularly, is concerned with a rotatable cam lock fitting having a pair of double cam levers providing an ergonomic safety lock and a lever latching mechanism thereon.

Description of the Related Art

Cam lock fittings having double cam levers have been described in the related art, and, cam lock fittings having safety features have been described in the related art. However, none of the related art devices disclose the unique features of the present invention.

U.S. Pat. No. 4,802,694 to Vargo, dated Feb. 7, 1989, disclosed a quick-disconnect coupling. However, in use the coupling of Vargo was plagued by the problem that its handles **64**, **60** and **74**, **68** could be inadvertently opened simultaneously by an operator, thus making it dangerous to use; this occurred because the handles were disposed in side-by-side relation as shown in FIGS. **2** and **4**. The present invention overcomes this problem by requiring that the outer handle **62** be opened prior to the inner handle **64**. Vargo actually teaches away from the present invention because it relied on springs **50** to retain the safety handles **64**, **68** in their locked positions unlike the present invention which has outer and inner handles **62**, **64** (See Vargo, Column 9, lines 52-56).

U.S. Pat. No. 8,955,885 to Dixon, dated Feb. 17, 2015, disclosed a hose coupling locking mechanism. U.S. Pat. No. 8,172,271 to Dixon, dated May 8, 2012, disclosed a hose coupling locking mechanism. U.S. Pat. No. 6,543,812 to Chang, dated Apr. 8, 2003, disclosed a self-locking quick release coupler adapted to a groove adapter. U.S. Pat. No. 5,904,380 to Lee, dated May 18, 1999, disclosed a pipe joint. U.S. Pat. No. 5,791,694 to Fahl, et al., dated Aug. 11, 1998, disclosed a lock for coupling cam arms. U.S. Pat. No. 3,439,942 to Moore, et al., dated Apr. 22, 1969, disclosed a retaining member for coupling. U.S. Pat. No. 6,095,190 to Wilcox, et al., dated Aug. 1, 2000, disclosed a coupling with a female half having internal pressure relief. U.S. Pat. No. 5,863,079 to Donais, et al., dated Jan. 26, 1999, disclosed a quick-connect, disconnect coupling. U.S. Pat. No. 5,595,217 to Gillen, et al., dated Jan. 21, 1997, disclosed a dry break coupling assembly with a cam locking connection system. U.S. Pat. No. 5,234,017 to Alfin, et al., dated Aug. 10, 1991, disclosed a restrictor valve for metered liquid dispensing system. U.S. Pat. No. 4,538,632 to Vogl dated Sep. 3, 1985, disclosed a shut-off valve for a fuel truck or tanker drain off having down spouts. U.S. Pat. No. 4,269,215 to Odar dated May 26, 1981, disclosed a vapor flow control valve. U.S. Pat. No. 3,1860,274 to Ledstrom, et al., dated Jan. 14, 1975 disclosed a pipe coupling, U.S. Pat. No. 4,222,593 to Lauffenburger disclosed a fluid conveying coupling with safety locking device. U.S. Pat. No. 8,123,255 to Hartman dated Feb. 28, 2012 disclosed a safety lock for a cam lock fitting. U.S. Pat. No. 7,147,004 to Hartman dated Dec. 12, 2006 disclosed a check valve for a cam lock fitting. U.S. Pat. No. 3,383,123 to Murray dated May 14, 1968 disclosed a line pressure responsive safety coupling. U.S. Pat. No. 5,338,069 dated Aug. 16, 1994 to McCarthy disclosed a positively locking quick release coupling. U.S. Pat. No. 8,632,103 dated Jan. 21, 2014 to Fahie, et al. disclosed a lock for cam and groove coupler. U.S. Pat. No. 3,124,374 dated Mar. 10, 1964 to Krapp disclosed a self venting separable coupling with lock. U.S. Pat. No. 5,295,717 dated Mar. 22, 1994 to Chen disclosed a tube connecting device that disclosed a lever latching mechanism. U.S. Pat. No. 5,435,604 dated Jul. 25, 2995 to Chen disclosed a tube connecting device that disclosed a lever latching mechanism. U.S. Pat. No. 8,083,265 dated Dec. 27, 2011 to Chen disclosed a tube connecting device that disclosed a lever latching mechanism. U.S. Pat. No. 5,722,697 dated Mar. 3, 1998 to Chen disclosed a fitting with two tubular members rotatable relative to each other.

While these devices related to cam lock fittings may be suitable for the purposes for which they were designed, they would not be as suitable for the purposes of the present invention, as hereinafter described. As will be shown by way of explanation and drawings, the present invention works in a novel manner and differently from the related art.

SUMMARY OF THE PRESENT INVENTION

The present invention discloses an improved rotatable cam lock fitting having cooperating ergonomically designed double cam levers having outer and inner portions so that when the outer cam levers are opened and the inner cam lever remain closed, the male and female portions of the cam lock fitting only slightly separate from each other allowing the operator to quickly reclose the cam lock fitting if the operator observes that the cam lock fitting still contains pressurized material. This is accomplished by providing a larger cam lobe on the outer cam lever and a fork shaped smaller cam lobe on the inner cam lever so that after the outer cam lever has been opened and the smaller cam lobe is in a closed position and protrudes into the peripheral groove on the male portion, the male and female ends have a small space therein between which allows the operator to visually observe any pressurized material so that the operator can quickly reclose the fitting. Also disclosed are embodiments which provide alternative lever latching mechanisms that must be unlatched before the cam levers can be opened thereby preventing the cam levers from being inadvertently opened. Alternative embodiments are also provided for the configuration of the cam portions relative to each other.

A major problem sought to be solved by the present invention occurs at the time an operator of a conventional prior art cam lock fitting undertakes the operation of opening the fitting; at that time, the operator may not know whether the contents of the conventional fitting are still under pressure, and if the contents are still under pressure the contents will spew out when the conventional fitting is opened possibly resulting in injury to the operator or an unwanted release of materials to the environment. The present invention solves this problem by allowing the improved cam lock fitting to be only partially opened by means of a safety lock feature which allows the improved fitting to be reclosed if the operator observes that the contents inside the improved fitting remain pressurized.

An object of the present invention is to provide a cam lock fitting having a pair of cooperating double cam lock levers

thereon. A further object of the present invention is to provide a safety lock which can be easily operated by a user as a part of the normal operation of a cam lock fitting. A further object of the present invention is to provide a safety lock which will remain locked when the cam lock fitting is pressurized. A further object of the present invention is to provide a safety lock on a cam lock fitting which will prevent inadvertent pressurized discharges of environmentally damaging material from the cam lock fitting. A further object of the present invention is to provide a safety lock on a cam lock fitting which is simply constructed and which can be relatively inexpensively manufactured. A further object of the present invention is to provide a cam lock fitting having a pair of cooperating double cam lock levers having a lever latching mechanism thereon. A further object of the present invention is to provide a cam lock fitting which is rotatable.

A major advantage of the preset invention is that the cam members are disposed substantially 180 degrees apart and therefore all forces related to associated stress or torque resulting from using the cam members are evenly distributed around a cam lock fitting designed according to the teachings of the present invention. Conventional cam lock fittings using side-by-side cam members would not be expected to exhibit this characteristic.

The foregoing and other objects and advantages will appear from the description to follow. In the description, reference is made to the accompanying drawings, which form a part hereof, and in which is shown by way of illustration specific embodiments in which the invention may be practiced. These embodiments will be described in sufficient detail to enable those skilled in the art to practice the invention, and it is to be understood that other embodiments may be utilized and that structural changes may be made without departing from the scope of the invention. In the accompanying drawings, like reference characters designate the same or similar parts throughout the several views.

The following detailed description is, therefore, not to be taken in a limiting sense, and the scope of the present invention is best defined by the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

In order that the invention may be more fully understood, it will now be described, by way of example, with reference to the accompanying drawings in which:

FIG. **1** is a perspective view of a prior art cam lock fitting.

FIG. **2** is a perspective view of a first embodiment of the present invention.

FIG. **3** is a perspective view of a second embodiment of the present invention.

FIG. **4** is an exploded perspective view of a first embodiment of the present invention.

FIG. **5** is a perspective view of the double cam lever of a first embodiment of the present invention.

FIG. **6** is an exploded perspective view of a second embodiment of the present invention.

FIG. **7** is a perspective view of the double cam lever of a second embodiment of the present invention.

FIGS. **8-10** are sectional views of a first embodiment of the present invention with certain parts shown in perspective for ease of illustration.

FIGS. **11-13** are sectional views of a second embodiment of the present invention with certain parts shown in perspective for ease of illustration.

FIG. **14** is an end elevation view taken from the front of portions of a first embodiment of the present invention.

FIG. **15** is an end elevation view taken from the front of portions of a second embodiment of the present invention.

FIG. **16** is a side elevation view of the double cam lever of a first embodiment of the present invention.

FIG. **17** is a side elevation view of the double cam lever of a second embodiment of the present invention.

FIG. **18** is a side elevation view of the double cam lever of an alternative embodiment of the present invention.

FIG. **19** is a top view on the inner cam lever of a first embodiment of the present invention.

FIG. **20** is an exploded perspective view of a lever latching embodiment of the present invention.

FIG. **21** is a perspective view of a lever latching embodiment of the present invention.

FIG. **22** is a perspective view of an alternative lever latching embodiment of the present invention.

FIGS. **23-24** are side elevation views of a lever latching embodiment of the present invention with certain parts shown cut-away for ease of illustration.

FIG. **25** is a top view of the double cam lever of an alternative embodiment of the present invention.

FIG. **26** is an end elevation view of the double cam levers taken from the front of portions of an alternative embodiment of the present invention.

FIG. **27** is an end elevation view of the double cam levers taken from the front of portions of an alternative embodiment of the present invention.

FIG. **28** is a top view of the double cam lever of an alternative embodiment of the present invention.

FIG. **29** is a top view of the double cam lever of an alternative embodiment of the present invention.

FIG. **30** is a side elevation view of the double cam lever of an alternative embodiment of the present invention.

FIG. **31** is an exploded perspective view of an alternative embodiment of a lever latching mechanism of the present invention.

FIG. **32** is a top view of an alternative embodiment of a lever latching mechanism of the present invention.

FIG. **33** is a side elevation view of a plate of an alternative embodiment of a lever latching mechanism of the present invention.

FIGS. **34-35** are side elevation views of an alternative embodiment of a lever latching mechanism of the present invention with certain pans shown cut-away for ease of illustration.

FIG. **36** is an exploded perspective view of an alternative embodiment of a lever latching mechanism of the present invention.

FIG. **37** is a top view of an alternative embodiment of a lever latching mechanism of the present invention.

FIG. **38** is a side elevation view of a plate of an alternative embodiment of a lever latching mechanism of the present invention.

FIGS. **39-40** are side elevation views of an alternative embodiment of a lever latching mechanism of the present invention.

FIG. **41** is a perspective view of a third embodiment of the present invention.

FIG. **42** is an exploded perspective view of a third embodiment of the present invention.

FIG. **43** is a perspective view of the double cam lever of a third embodiment of the present invention.

FIG. **44** is a perspective view of a lever latching embodiment of a third embodiment of the present invention.

FIGS. **45-47** are sectional views of a third embodiment of the present invention with certain parts shown in perspective for case of illustration.

FIG. **48** is an end elevation view taken from the front of portions of a third embodiment of the present invention.

FIG. **49** is a side elevation view of the double cam lever of a third embodiment of the present invention.

FIG. **50** is a side elevation view of the double cam lever of a third embodiment of the present invention.

FIG. **51** is an exploded perspective view of an alternative lever latching embodiment of the present invention.

FIG. **52** is a perspective view of an alternative lever latching embodiment of the present invention.

FIG. **53** is a top view of each lever of an alternative lever latching embodiment of the present invention.

FIG. **54** is a top view of an alternative lever latching embodiment of the present invention showing the levers in an assembled disposition.

FIG. **55** is a side elevation view of an alternative lever latching embodiment of the present invention shown in a closed position with certain parts shown cut-away for ease of illustration.

FIG. **56** is a side elevation view of an alternative lever latching embodiment of the present invention shown in an open position with certain parts shown cut-away for ease of illustration.

FIG. **57** is an exploded perspective view of an alternative embodiment of the present invention.

FIGS. **58-60** are sectional views showing the steps of operating and assembling an alternative embodiment of the present invention with certain parts shown in elevation for ease of illustration.

REFERENCE NUMERALS

With regard to reference numerals used, the following numbering is used throughout the drawings.

10 prior art cam lock fitting
12 female end portion
14 male end portion
16 front end
18 hose
20 band clamp
22 rear end
24 cam lever/ear
26 lever portion
28 cam portion
30 groove
32 opening
34 wall of cam lock fitting
36 axle
38 flange
40 gasket
42 boss
44 boss
46 centerline
48 an alternative double lever cam lock
50 an alternative double lever cam lock
52 an alternative double lever cam lock
54 cam lock fitting
56 female end portion/conduit
58 male end portion/conduit
60 front end
62 outer cam lever/ear
64 inner cam lever/ear
66 lever portion
68 cam lobe portion
70 lever portion
72 cam lobe portion
74 axle
76 aperture of cam lobe
78 boss
79 sidewall
80 boss
81 sidewall
82 aperture of boss
83 cross member
84 rear end
86 groove
88 opening
90 axle
92 aperture
94 aperture
96 cam lobe portion
98 circular gasket/seal
100 inside
102 wall
104 flange
106 space
108 arrow
110 cutout/space
112 rear portion
113 lever latching mechanism or lock assembly
114 pull ring member
116 end of pin
118 pin
120 aperture of pin
122 housing for pin
124 tip end of pin
126 inclined surface of pin
128 retaining protrusion
129 latch body/retaining member
130 retaining protrusion
131 notch
132 spring biasing member
134 finger of user
136 space
138 alternative embodiment double lever cam lock
140 alternative embodiment double lever cam lock
142 larger cam member with larger arm
144 smaller cam member with smaller arm
146 cylindrical spacer
147 latch mechanism or lock assembly
148 latch lever/arm
150 pivot
152 spring biasing means
154 thumb grip
156 first catch for outer ear
158 second catch for inner ear
160 cam member
162 cam member
164 boss
166 mount
168 plate
170 aperture of plate
172 offset
174 front inner surface
176 rear inner surface
178 latch mechanism or lock assembly
180 latch member/clip
182 pivot
184 clamp portion
186 plate
188 slot for ring

190 length
192 width
194 shield/hand guard
196 collar bushing/bushing
198 spacer
200 rear lip of inner cam lever
202 aperture
211 cam lock fitting of the present invention
212 female end portion
214 male end portion
216 front end
224 cam lever/ear/arm
226 lever portion
230 groove
232 opening
240 gasket
250 connecting collar
252 front end of connecting collar
254 rear end of connecting collar
256 outer flange
258 front section of female end portion
260 tail section of female end portion
262 inner flange
264 outer surface of connecting collar
266 interior surface of tail section
268 front end portion of tail section
270 rear end portion of tail section
272 press fit portion

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The following discussion describes in detail at least one embodiment of the invention. This discussion should not be construed, however, as limiting the invention to those particular embodiments since practitioners skilled in the art will recognize numerous other embodiments as well. For a definition of the complete scope of the invention, the reader is directed to the appended claims. FIGS. **1-60** illustrate the present invention wherein a cam lock fitting having a pair of double cam levers which cooperate to provide a safety locking mechanism is disclosed.

Turning to FIG. **1**, therein is shown a prior art version of a conventional cam lock fitting generally indicated by reference number **10** having a female end coupling portion or conduit **12** and a male end coupling portion or conduit **14** each having a front end **16** which when joined together form a conduit through which fluid or the like will flow. A hose **18** having a band clamp **20** thereon is attached to a rear end **22** of each female **12** and male **14** portions; hose **18** ranges in size from about one inch to about 8 inches and are generally heavy for accommodating relatively high pressure. The female portion **12** has a pair of cam levers or ears **24** each having a lever portion **26** and a cam portion **28** thereon, which cam portion locks the female end **12** to the male end **14** by seating the cam portion **28** of the female portion within a peripheral groove **30** on an exterior of the male portion so that the two portions **12**, **14** with hoses **18** are joined together to form a conduit so that materials can pass therethrough. The cam portion **28** projects through an opening **32** in the wall **34** near the font end **16** of the female portion **12** as the ears **24** pivot on axles **36**. Direction arrows are used to show movement of ears **24** between a closed position lying substantially parallel to and adjacent the female portion **12** and an open position outwardly moved away from the female portion **12** so as to disengage the cam portion from groove **30**. Also shown on the inside of the female portion **12** is annular flange **38** having a flexible circular gasket or O-ring seal **40** therein wherein the flange and gasket extend entirely around the internal periphery of the female portion for making sealing contact with the end **16** of the male end portion **14** in a conventional manner. The ears **24** are each mounted onto an axle **36** extending through first, left and second, right bosses **42**, **44** disposed on opposite sides of the female coupling **12**. Centerline **46** of cam lock fitting **10** is also shown. A major disadvantage of the prior art cam lock fitting **10** is that it is designed to be either completely closed or completely open and therefore offers no safety locking mechanism.

Turning to FIGS. **2-3** and FIG. **41**, therein are shown three embodiments **48**, **50**, **52** of an improved cam lock fitting **54** of the present invention wherein FIG. **2** shows embodiment **48**; FIG. **3** shows embodiment **50**; and FIG. **41** shows embodiment **52**. FIGS. **2-3** and FIG. **41** show a cam lock fitting **54** similar in some respects to the prior art cam lock fitting **10**, shown in FIG. **1**, but with important differences due to the embodiments **48**, **50**, **52** mounted thereon. Therein is shown a cam lock fitting **54** having a female end coupling portion or conduit **56** and a male end coupling portion or conduit **58** each having a front end **60** which when joined together form a conduit through which fluid or the like will flow. The present invention operates similarly to the prior art am lock fitting **10** shown in FIG. **1** except that there are a total of four cam levers (i.e., two pairs of double cam levers/ears) instead of two cam levers wherein the double cam levers cooperate with each other to provide a safety lock. Each of the cam lock fittings **54** shown in FIGS. **2-3** and FIG. **41** are similar to each other, however, different embodiments **48**, **50**, **52** of cam lock levers are mourned thereon.

Turning to FIG. **2**, therein is shown the embodiment **48** having a pair of double cam levers or members **62**, **64** mounted on opposite sides of the female end portion **56** wherein each pair has an outer cam lever **62** and an inner cam lever **64**. Outer cam lever **62** has a lever portion **66** and an eccentric cam lobe portion **68**, and, inner cam lever **64** also has a lever portion **70** and first and second eccentric cam lobe portion **72** wherein the first and second cam lobe portions form the two prongs of a fork shaped portion being spaced apart a distance thereby creating a cutout or space **110** sufficient to allow the cam lobe portion **68** to fit therein between the two prongs which causes the inner and outer cam levers **62**, **64** to be disposed symmetrically about the female end portion **56** which assures smooth operation throughout the life span of a cam lock fitting **54** made according to the teachings of the present invention. The cam lobe portion **72** resembles a fork shape when viewed from the top (see FIG. **19**) wherein the two similar first and second prongs/branches of the fork have cam lobe **68** disposed therein between in space **110**; of course, the positions of the lobes **68**, **72** could be reversed relative to each other wherein the larger lobe portion **68** could be manufactured as the forked portion **72** so that the smaller lobe portion would be disposed on the inside of the larger forked portion as shown in FIG. **18**. The lever portion **66** of the outer cam ear **62** is larger, i.e., wider, than the lever portion **70** of the inner cam ear **64** so that it will be easier to grasp in the hands of an operator; also, the inner cam ear is not intended to be opened until after the outer cam ear is opened and having a wider outer ear helps accomplish this objective. A lever latching mechanism **113** for use with lever **62**, **64** is described in FIGS. **20-24**.

A single axle **74** passes through a substantially centrally disposed aperture **76** of cam lobe portion **68**, **72** and the ends

of the axle are carried on first and second bosses **78**, **80** by passing through an aperture **82** of each boss. The male and female end portion **56**, **58** each have a rear end portion **84** and the male end portion has an external peripheral groove **86** thereon. The female end portion **56** has openings **88** in the opposing walls thereof through which cam lobes **68**, **72** pass. Cam lobe portion **68** of outer cam ear **62** is configured differently and may be larger than cam lobe portion **72** of inner cam ear **64**, as best shown on FIGS. **8-10** and FIG. **16**, so that when the outer and inner ears **62**, **64** are closed the cam lobe portion **68** fits in or engages groove **86** so as to completely sealingly close or connect the male end portion **58** to the female end portion **56** because cant lobe **68** is substantially the same size and shape of the groove **86**. This is due to cam lobe **68** being effectively configured, in size or shape, so as to engage groove **86** in such a way to cause the end **60** of male conduit **58** to move axially into a sealing position relative to the sealing gasket inside female conduit **56**. In contrast, when the outer cam ear **62** with cam lobe **68** is opened and the smaller cam lobe **72** is unopened, the male end portion **58** becomes slightly loosened or separated from the female end portion **56** to allow a space to form between the front end **60** of the male end portion **58** and the female end portion **56** as best shown and explained relative to FIGS. **8-13**, because smaller cam lobe **72** being smaller, i.e., being configured differently, than groove **86** doesn't completely fill groove **86** being loose fit thereby causing a slight space to form between front end **60** and the female end portion **56** as previously disclosed.

In summary of FIGS. **2-11** and FIG. **41**, the female portion **56** has a pair of double cam levers or ears **48**, each having an outer and inner lever portion **66**, **70** and a cam portion **68**, **72** thereon, which cam portion locks the female end **56** to the male end **58** by seating the cam portions **68**, **72** of the female portion within a groove **86** on the male portion so that the two portions are joined together. The cant portions **62**, **64** project through an opening **88** in the wall near the end **60** of the female portion **56** as the ears **62**, **64** pivot on axle **74**. Also included in the female portion **56** is a gasket or O-ring seal **98** therein wherein the gasket extends entirely around the internal periphery of the female portion for making sealing contact with the end **60** of the male end portion **58** in a conventional manner as shown in FIGS. **8-13** and **45-47**. The ears **62**, **64** are each mounted onto an axle **74** extending through a first and second boss **78**, **80** mounted on opposite sides of female coupling **56**. The inner and outer ears **62**, **64** each move between a first downward closed position lying substantially parallel to and adjacent the female portion **56** to a second upward open position outwardly moved away from the female portion so as to disengage the cam portion **68**, **72** from groove **86**.

In order for an operator to open a cam lock fitting **54** designed according to the teachings of the present invention, the operator must first move the outer cam lever **62** from the first downward closed position to the second upward open position so that larger cam lobe **68** is moved away from groove **86** so as to partially open the cam lock fitting **54** so as to partially relieve internal pressure contained inside the cam lock fitting. If there is no pressure remaining in the cam lock fitting **54** the operator can continue with the next step of opening the second inner cam lever **64** to thereby separate the male and female conduit portions **58**, **56** just as previously explained relative to embodiment **48** of FIG. **2**. However, if there is still pressure inside the cam lock fitting **54** when the first outer cam lever **62** is opened, the operator will immediately reclose that first outer cam lever **62** so as to pull the male end portion **58** back into the locked position inside female end portion **56** so as to reclose and reseal the cam lock fitting. Pressure remaining inside cam lock fitting **54** could be indicated by the sound of escaping gas, a hissing sound, seepage, leaking or gurgling liquid or the like.

Turning to FIG. **3**, therein is shown a view similar to FIG. **2** except that another embodiment **50** of the double cam lever is shown having double axles **74**, **90**. The female and male end portions **56**, **58** are essentially the same as shown in FIG. **2** with the main difference being that inner cam ear **64** is mounted onto bosses **78**, **80** using axle **90** in aperture **92** which axle **90** is offset from the center of lobe **72** toward the front end **60** of the female end portion **56** so as to be disposed toward the front ends of bosses **78**, **80** in aperture **94** as best shown on FIGS. **6-7**. Axle **90** and apertures **92**,**94** are co-aligned as shown in FIG. **6**. In this configuration, while outer cam ear **62** pivots on substantially centrally disposed axle **74** on earn lobe **72**, it is carried with and moves outwardly with inner cam ear **64** by having cam lobe portion **72** pivot on offset axle **90** which is better illustrated in FIGS. **6-7** and **11-13**. The operation of embodiment **50** is similar to embodiment **48** and the steps of operation have been previously disclosed relative to embodiment **48** of FIG. **2**.

Turning to FIGS. **4**, **6**, and **42** the three embodiments **48**, **50**, **52** of an improved cam lock fitting of the present invention are exploded away from a female end portion **56**; wherein FIG. **4** shows embodiment **48**, FIG. **6** shows embodiment **50**, and FIG. **42** shows embodiment **52**. Shown therein is the inside **100** of the female coupling **56** along with the alternative double cam levers **48**, **50**, **52** on opposite sides of the female end portion **56** showing the bosses **78**, **80** on the female coupling **56**. Note that the openings **88** are sized and shaped to accommodate movement of the cam lobes of the present invention. The bosses **78**, **80** are attached onto the outside of the female coupling **56** in the conventional manner. Previously disclosed elements are also shown as were discussed relative to the respective embodiments **48**, **50**, **52** of FIGS. **2-3** and FIG. **41**.

Turning to FIGS. **5**, **7**, and **43** an enlarged view of the cam portions of the three embodiments **48**, **50**, **52** are shown illustrating the features of the two embodiments as previously disclosed relative to the respective embodiments **48**, **50**, **52** of FIGS. **2-3** and FIG. **41**. FIG. **5** shows single axle embodiment **48**, FIG. **7** shows a double axle embodiment **50** and FIG. **43** shows embodiment **52**. FIG. **43** also shows dimension lines for length **190** and width **192** on outer cam lever **62** and it is expected that the length and width of the outer cam lever **62** will be an effective amount greater than the length and width of the corresponding portions of inner cam lever **64** causing outer cam lever **62** to have a greater surface area than inner cam lever **64** to assist in preventing inner cam lever **64** from being inadvertently opened before outer cam lever **62** and to prevent cam levers **62**, **64** from being inadvertently opened together and to insure that the fingers or hand of a user grasp outer cam lever **62** first to be sure it is opened prior to underlying inner cam lever **64**, The neck area/portion of outer cam lever **62** may also be longer than the neck area/portion of the inner cam lever **64** as disclosed relative to other previously disclosed embodiments. Previously disclosed elements are also shown as were discussed relative to the respective embodiments **48**, **50**, **52** of FIGS. **2-3** and FIG. **41**.

Turning to FIGS. **8-13** and FIG. **45-47**, therein is shown the steps of operation of the three embodiments **48**, **50**, **52** of an improved cam lock fitting **54** designed according to the teachings of the present invention wherein FIGS. **8-10** shows embodiment **48**, FIGS. **11-13** shows embodiment **50**

and FIGS. **45-47** shows embodiment **52**. For each embodiment **48**, **50**, **52** therein is shown the movement of the male end portion **58** relative to the female portion **56** as the cam lock fitting **54** of the present invention is being opened; the steps would be reversed for closure of the cam lock fitting. FIGS. **8**, **11** and **45** show the male end portion **58** connected to and mated tightly to the female portion **56** as would be the condition when the cam lock fitting **54** is in a sealed position with double cam lever **62**, **64** in a downward closed position so that the end **60** of the male end portion **58** is tightly sealingly enraged against the front side of circular gasket **98** of the female end portion **56** with the lobes **68**, **72** or **96** in groove **86**; also, the rear side of gasket **98** is tightly sealed against the front surface of the inner flange **104** of the female end portion **56**.

In contrast, FIGS. **9**, **12** and **46** shows the larger cam lobe of outer cam lever **62** in the open position and shows the smaller cam lobe **72**, **96** of inner cam lever **64** remaining in the groove **86** and also shows the male end portion **58** with a small space **106** being defined in between its end **60** and the gasket **98** which would occur when the outer cam lever **62** is in an upward open position which would cause the ends **60** of female end portion **56** and male end portion **58** to slightly separate thereby allowing the release of pressure or a small amount of material as indicated by arrows **108** from the inside of the female portion **56** of the cam lock fitting **54**. Arrows **108** illustrate material/fluid moving into space **106** and then out the fitting **54** by escaping between the male and female couplings **58**, **56**. FIGS. **10**, **13** and **47** illustrate that the male end **58** can only be completely released from the female end **56** when the outer and inner cam levers **62**, **64** are both moved to the open position and when this occurs, each of the lobes **68**, **72**, **96** become disengaged from groove **86** to allow the male **58** and female **56** end to be completely separated from each other. Previously disclosed elements may also be shown.

Turning to FIGS. **14-15** and **48**, the three embodiments **48**, **50**, **52** of an improved cam lock fitting of the present invention are shown mounted on a female end portion **56** also showing portions of the male end portion **58** along with groove **86** in phantom line; wherein FIG. **14** shows embodiment **48**, FIG. **15** shows embodiment **50** and FIG. **48** shows embodiment **52**. Shown therein is the inside **100** of the female coupling **56** along with the alternative double cam levers **48**, **50**, **52** on one side only of the female end portion **56** showing the bosses **78**, **80** on the female coupling **56**. Note that the openings **88** are sized and shaped to accommodate movement of the cam lobes of the double levers of the present invention; also, it should be clear that the lobes and levers could have many shapes and thicknesses other than those which are illustrated so long as they are effectively sized and shaped to accomplish the teachings of the present invention all of which would be understood by one skilled in the art. The bosses **78**, **80** are attached onto the outside of the female coupling **56** in the conventional manner. In FIG. **15**, the axles **74**, **90** lie in the same horizontal plane and therefore only the front axle **90** in aperture **92** is visible in this drawing. Previously disclosed elements may also be shown as were discussed relative to the respective embodiments **48**, **50**, **52** of FIGS. **2-3** and FIG. **41**.

Turning to FIGS. **16-17** and FIG. **49**, enlarged views of the alternative double cam levers/ears of the three embodiments **48**, **50**, **52** are shown illustrating the features of the three embodiments as previously disclosed relative to the respective embodiments **48**, **50**, **52** of FIGS. **2-3** and FIG. **41**. FIG. **16** shows embodiment **48**, FIG. **17** shows embodiment **50** and FIG. **49** shows embodiment **52**. In FIGS. **16**,**17**, cam lobe **68** of outer cam ear **62** is larger, i.e., having a larger radius on its rear peripheral portion **112** which is visible when closed, than cam lobe **72** of inner cam ear **64** as shown at **112**. In FIG. **49** cam lobe **68** of outer cam ear **62** is larger than cam lobe **96** of inner cam ear **64**. Regarding FIGS. **16-17** and FIG. **49**, because cam portion **68** has a larger radius or enlargement on its rear portion **112** than cam portion **72**, **96** as measured at its horizontal plane through its central axle, it therefore is configured to extend further to the rear and effectively and substantially fills or engages the complimentarily sized groove **86** causing a complete seal between the gasket **98** and the male end portion **58** in the closed position as shown in FIGS. **8**, **11** and **45**; however, after the outer cam lever/ear **68** has been opened and when the smaller cam lobe portion **72**, **96** protrudes into groove **86** it doesn't completely fill the groove so the space **106** is formed as shown in FIGS. **9**, **12** and **46** between the end **60** of the male end **58** and the gasket **98** of the female end portion **56**. FIGS. **10**, **13** and **47** show the female **56** and male **58** ends completely separated with cam lever/ears **62**, **64** in the open position. Also, FIG. **16-17** and FIG. **49** show outer cam lever **62** overlying inner cam lever **64**.

Turning to FIG. **18**, therein is shown an alternative embodiment of the present invention showing the inner cam lever **64** being larger on its rear peripheral portion **112** than the outer cam lever **62**. Previously disclosed elements are also shown, FIG. **25** shows a top view of the alternative embodiment of FIG. **18** showing the inner cam lever **64** being larger than the outer cam lever **62**.

Turning to FIG. **19**, therein is shown a top view of the inner cam lever **64** of the first embodiment of the present invention showing previously disclosed elements. Space/cutout **110** between the prongs of the forked ends of the cam lobe portions **72** is also shown. It can be seen that the cam lobe portions **72** form the prongs of the forked portion.

With reference to embodiments **48**, **50** and **52**, the cam members **62**, **64** pivot substantially in a vertical plane passing through the centerline of the cam lock fitting/coupling **54** with the axles **74**, **90** being substantially perpendicular to the centerline, and, the cam members are disposed on the bosses **78**, **80** so that the cam lobes **68**, **72**, **96** and the axles will be properly operationally aligned with the groove **86** as required by each embodiment **48**, **50**, **52** all of which would be understood by one skilled in the art. The axles **74**, **90** may be solid or hollow pins, roll pins or the like. Cam members **62**, **64** are disposed substantially 180 degrees apart on opposite sides of the female conduit **56** and therefore all mechanical forces related to associated stresses or torque resulting from operation of the cam members are evenly distributed around the cam lock fitting **54**. This will prevent warping of the elements of the present invention over time.

Turning to FIGS. **20-24**, therein is shown an embodiment of the present invention **10** which provides an automatic lever latching mechanism disposed on levers **62**, **64**, generally indicated by reference numeral **113**, so that when the levers **62**, **64** are moved from an open position into a closed position they become automatically latched in the closed position so that before an operator opens the levers he will have to actuate a member or pull ring member **114** or the like in order to open the first and second levers **62**, **64**, or as shown in FIG. **22**, he would use the or pull ring **114** to open only one lever which would have the lever latching mechanism or lock assembly **113** thereon. The lock assembly **113** would be in mechanical cooperation with the cam members **62**, **64** to prevent the unintentional movement thereof. In

either embodiment, the operator would have to operate a lever latching mechanism **113** before he could open the levers **62**, **64** thereby preventing the cam levers from being inadvertently opened. Inner lever **64** is shorter than outer lever **62** for convenience and ease of operation by the operator/user although they may be of the same length. Previously disclosed elements are also shown as were discussed relative to the respective embodiments **48**, **50** of FIGS. **2-3**.

Continuing with FIGS. **20-24**, therein is shown the present invention **10** having a pair of double cam levers **62**, **64** mounted on opposite sides of the female end portion **56** wherein each pair has an outer cam lever **62** and an inner cam lever **64**. Outer cam lever **62** has a lever portion **66** and an eccentric cam lobe portion **68**, and, inner cam lever **64** also has a lever portion **70** and first and second eccentric cam lobe portions **72** wherein the first and second cam lobe portions are fork shaped and spaced apart a distance thereby creating a cutout **110** or space sufficient to allow the cam lobe portion **68** to fit therein between which causes the inner and outer cam levers **62**, **64** to be disposed symmetrically about the female end portion **56** which assures smooth operation throughout the life span of a cam lock fitting **54** made according to the teachings of the present invention **10**. FIGS. **20**, **21**, **23** and **24** discloses embodiment **48** which uses a single axle **74** whereas FIG. **22** discloses embodiment **50** which uses double axles **74** and **90**.

Turning to FIG. **20**, therein is shown the present invention **10** exploded away from the female end portion **56** and incorporates embodiment **48**. Shown therein is the inside **100** of the female coupling **56** along with the double cam levers **48** on opposite sides of the female end portion **56** showing the bosses **78**, **80** on the female coupling **56**. Note that the openings **88** are sized and shaped to accommodate movement of the cam lobes of the present invention. The bosses **78**, **80** are attached onto the outside of the female coupling **56** in the conventional manner. Male end portion **58** is also partially shown in phantom line. Previously disclosed elements are also shown as were discussed relative to the respective embodiments **48**, **50** of FIGS. **2-3**.

Also shown in FIG. **20**, is a pull ring member **114** attached to an end **116** of a pin **118** wherein the pull ring passes through a slot or aperture **120** on an end of the pin which pin is slidably disposed in a housing **122** attached onto a side of lever **62**, **64** so that each lever **62**, **64** has a housing **122** and a pin **118** (pin **118** may be referred to as an engagement member in the claims) mounted thereon. Pull ring member **114** may be a multi-turn wire ring being useful for manipulating levers **62**, **64**. Note that the pin or engagement member **118** is mounted inside the housing **122** so as to be slidably disposed in the housing so that the pin slides along the longitudinal axis of the levers **62**, **64**. The pin **118** also has a second end or tip **124** having an inclined surface **126** thereon. The pin **118** extends along and is slidable along an axis of a respective lever **62**, **64** so that when the levers **62**, **64** are in a closed position the tip **124** of pin **118** latches underneath the rear portion of upper and lower corresponding retaining protrusions **128**, **130** disposed on a rear portion of boss **78** as best seen in FIG. **23**.

Continuing with FIGS. **20-24**, when the respective members or pull ring members **114** of levers **62**, **64** are pulled rearwardly toward end **84** of female conduit **56** in the direction along the axis of the pin **118**, the pin **118** is moved in a bore within the housing **122** against the biasing member, being spring **132**, as would be understood by one skilled in the art. In operation, when the levers **62**, **64** are pivoted from the open position to the locking position the inclined surface **126** of the tip of the pin **124** of each pin **118** eventually abuts against the rear upper surface of retaining protrusion **128**, **130** of the respective retaining protrusions so that the tip **124** of the pin moves downwardly across the surface of the respective retaining protrusions **128**, **130** due to further pivoting movement of the corresponding lever **62**, **64** so that the tip **124** of pin **118** becomes eventually positioned underneath the respective retaining protrusions **128**, **130** as the pin tip **124** is forced to be extended from the housing **122** due to the action of the internal spring **132** shown on each lever **62**, **64** as best seen in FIG. **23**. In operation, when the operator desires to disengage or to open the levers **62**, **64** and move them from a closed position to an open position the pull rings **114** are pulled toward the rear to retract the respective tips **124** of pins **118** in levers **62**, **64** back, into the housing **122** against the biasing, action of the springs **132** so that the tips of pin **124** become disengaged from underneath the rear of the respective retraining protrusions **128**, **130** so that the levers **62**, **64** can then be pivoted upwardly to an unlocked position so that the couplings **56**, **58** of the present invention **10** can be disengaged as best seen in FIG. **24**. In this manner, the male coupling **58** and female coupling **56** can become separated or disconnected, all of which would be understood by one skilled in the art.

Turning to FIG. **21**, therein is shown the embodiment **48** which has been previously disclosed in relation to FIG. **5** of the present invention **10** shown in combination with the previously disclosed lever latching mechanism **113**.

Turning to FIG. **22**, therein is shown the embodiment **50** which has been previously disclosed in relation to FIG. **7** of the present invention **10** shown in combination with the previously disclosed lever latching mechanism **113**.

Turning to FIGS. **22-24**, therein are shown partially cut-away side views of the present invention **10** showing pull rings **114** disposed on respective levers **62**, **64** being attached through an aperture **120** in the end of respective pins **118** also showing the housing **122** along with the biasing spring **132**, or the like, wherein the tips **124** of the pin are shown along with the inclined surface **126** and respective retaining protrusions **128**, **130** disposed on boss **78**. FIG. **23** shows the levers **62**, **64** in a closed position similar to FIG. **8**, and, FIG. **24** shows the levers **62**, **64** in an open position similar to FIG. **10** wherein the pull rings **114** of the levers **62**, **64** have been operated and moved by a finger **134** of an operator/uses so that the tips of the pin **124** are no longer captured underneath the corresponding retaining protrusions **128**, **130** of the bosses **78**. Inner lever **64** is shorter than outer lever **62** for convenience and ease of operation by the operator/uses. Levers **62**, **64** are configured so that the tip **124** of lever **64** mates with the retaining protrusion **130** and the tip **124** of lever **62** mates with retaining protrusion **128**. Direction arrows are shown in certain figures to indicate movement of the elements.

Turning to FIG. **25**, therein is shown a top view of the alternative embodiment showing the inner cam lever **64** being larger than the outer cam lever **62** as was previously disclosed with respect to FIG. **18**. It can be seen that inner arm **64** is configured, sized and shaped so that it can be moved from the closed position to the open position without touching or interference from the outer arm **62**. This is accomplished by providing a space **136** between inner arm **64** and outer arm **62** which allows inner arm **64** to substantially surround outer arm **62** so that the inner arm can be operated without moving the outer arm. It can be seen that the longitudinal central axis of the outer and inner cam levers **62**, **64** are substantially co-aligned so that the axis of the outer lever is directly above the axis of the inner lever.

Turning to FIGS. **26**, **28** and **30**, therein is shown an alternative embodiment **138** of an improved cam lock fitting of the present invention shown mounted on a female end portion **56**. Shown therein is the inside **100** of the female coupling **56** along with the double cam levers **142**, **144** mounted on an axle **74** in a side-bye-side relationship which axle is also mounted on the bosses **78**, **80** of the female coupling **56**. Note that the openings **88** are sized and shaped to accommodate movement of the cam lobes **68**, **72** of the double levers **142**, **144** of the present invention: also, it should be clear that the lobes and levers could have many shapes and thicknesses other than those which are illustrated so long as they are effectively sized and shaped to accomplish the teachings of the present invention all of which would be understood by one skilled in the art. The bosses **78**, **80** are attached onto the outside of the female coupling **56** in the conventional manner. It is expected that cam lever **142** would have the larger cam lobe **68** thereon relative to the cam lobe **72** but one skilled in the art would understand that these could be reversed. Alternative embodiment **138** shows a cam member **144** disposed adjacent a first boss **80**, wherein a spacer **146** is disposed on the axle **74** adjacent the second boss **78**, wherein the first cam member **142** is disposed between the other cam member **144** and the spacer **146**. FIG. **28** shows the ear or arm portion **66** of lever **142** being larger and disposed over ear portion **144** so that the ear or arm portion **66** of lever **142** is outside relative to ear portion **70** of lever **144** as best shown in FIG. **30**. Thus, lever **142** may be referred to as an outer lever and lever **144** as an inner lever. In order to accomplish this the neck area or portion between the cam lobe portion and the arm/lever portion of the outer lever may be shaped differently and be longer to extend further away from or be more vertically angled relative to housing **56** and some experimentation may be necessary to find the optimum shape, length or angle for the neck areas. The lever arm portion **66** of the outer cam ear **142** is larger, i.e., wider, than the lever portion **70** of the inner cam ear **144** so that it will be easier to grasp in the hands of an operator; also, the inner cam ear is not intended to be opened until after the outer cam ear is opened and having a wider outer ear helps accomplish this objective. A cylindrical spacer **146** is also shown mounted on the axle so as to cause the larger cam lever **142** to be precisely aligned with its corresponding larger cam lever **142** mounted on the opposite side of the female coupling **56** so as to balance all structural torques and forces so as to prevent warping of the housing **56** or axle **74** which may occur with conventional designs over a period of time. FIG. **30** shows an optional latch mechanism or lock assembly **147** useful for embodiment **138** including a latch arm or lever **148** which moves on a pivot **150** disposed on a pair of mounts **166** which lever is biased closed by spring **152**. Also shown is thumb grip **154** to allow a user to actuate the lever **148** along with a first catch **156** for the larger ear **142** and a second catch **158** for smaller ear **144**. In operation, the latch arm or lever arm **148** must be moved from the closed position to an open position before the cam levers **142**, **144** can be operated.
Previously disclosed elements may also be shown.

Turning to FIGS. **27** and **29**, therein is shown an alternative embodiment **140** of an improved cam lock fitting of the present invention shown mounted on a female end portion **56**. Shown therein is the inside **100** of the female coupling **56** along with the double cam levers **160**, **162** mounted on an axle **74** in a side-by-side relationship which axle is also mounted on the bosses **78**, **80**, and **164** of the female coupling **56**. Note that the openings **88** are sized and shaped to accommodate movement of the cam lobes **68**, **72** of the double levers **160**, **162** of the present invention; also, it should be clear that the lobes and levers could have many shapes and thicknesses other than those which are illustrated so long as they are effectively sized and shaped to accomplish the teachings of the present invention all of which would be understood by one skilled in the art. The bosses **78**, **80**, and **164** are attached onto the outside of the female coupling **56** in the conventional manner. It is expected that cam lever **160** would have the larger cam lobe **68** thereon relative to the cam lobe **72** but one skilled in the art would understand that these could be reversed. FIG. **29** shows the ear or arm portion **66**, **70** disposed in a side-by-side relationship with cam member **160** disposed between boss **80** and boss **164** and cam member **162** disposed between boss **78** and boss **164**. The cam member **160**, **162** are precisely aligned with its corresponding cam member on the opposite side of the female coupling **56** so as to balance all structural torques and forces so as to prevent warping of the housing **56** or axle **74** which may occur with conventional designs over a period of time. Having the third boss **164** assures that all structural torques and forces are balanced so as to prevent warping of the housing **56** or axle **74**. FIG. **30** shows an optional latch mechanism **147** useful for embodiment **140** including a latch arm or lever **148** which moves on a pivot **150** which pivot is biased closed by spring **152**. Also shown is thumb grip **154** to allow a user to actuate the lever **148** along with a first catch **156** or catch **158**. In operation, the latch lever arm **148** must be moved from the closed position to an open position before the cam levers **160**, **162** can be operated. Alternatively, the latch mechanism **113** disclosed in FIGS. **20-24** could be easily adapted for use with cam members **160**, **162**. Previously disclosed elements may also be shown.

Turning to FIGS. **31-35**, therein is shown an alternative embodiment of the present invention **10** which is similar in operation to the embodiment previously disclosed relative to FIGS. **20-24** except that instead of the retaining protrusions **128**, **130** being disposed on a rear portion of boss **78** they are disposed on a rear portion of a separate latch plate **168** which plate is mounted beside or adjacent the boss **78** in the vertical plane so as to be disposed between the nearer cam lobe portion **72** of cam lever **64** and boss **78** and being carried on axle **74** which axle passes through aperture **170** of the plate **168**. Plate **168** has an offset **172** so as to align protrusions **128**, **130** with tip **124** of pin **118** so as to avoid boss **78** as best seen in FIGS. **31** and **33**. Plate **168** is prevented from rotating about axle **74** in the vertical plane by having its front and rear inner surfaces **174**, **176**, respectively, contact the outer surface of wall **102** of female end portion/conduit **56** which wall **102** serves as a stop as best seen in FIG. **35**. Plate **168** is relatively thin and could be made of many types of material so as to be strong, durable and lightweight such as aluminum, steel, stainless steel or the like. Also shown on FIG. **31** is arm **62** having a conventional round pull ring member **114** made of multi-strands of wire and which is commonly used. FIG. **32** shows outer handle **62** overlying inner handle **64** and having a greater surface area. Previously disclosed elements are also shown.

Turning to FIGS. **36-40**, therein is shown art alternative embodiment of the present invention **10** which is similar in operation to the embodiment previously disclosed relative to FIGS. **31-35** except that instead of the two retaining protrusions **128**, **130** being disposed on a rear portion of separate latch plate **168**, the plate **186** has only one retaining protrusion **130** disposed thereon. The purpose of this embodiment is to reduce the weight and costs of manufac-

turing the present invention **10**. Furthermore, outer cam lever **62** has no housing **122** or pin **118** on its side but instead uses an optional latch mechanism or lock assembly **178** including a latch arm, clip or member **180** which member has one end which moves on a pivot **182** disposed on a rear portion of outer cam lever **62** and a second end having a spring steel portion forming a clamping portion or clamp **184** for frictionally engaging or mating with an inner surface of inner cam lever **64** so that that outer cam lever **62** is clamped/latched to inner cam lever **64** by using latch mechanism **178**. Also see that housing **122** and pin **118** are shortened on inner cam lever **64**. In operation, the latch member or clip **180** must be swung or moved from the closed position to an open position before the cam lever **62** can be released from cam lever **64** and thereby operated and opened as best seen in FIGS. **39-40**. One skilled in the art would also understand that the latch mechanism or lock assembly **147** shown relative to FIGS. **28** and **30** could be adapted for use instead of latch mechanism or lock assembly **178** with this alternative embodiment shown relative to FIGS. **36-40** which would allow the latch mechanism **178** to be removed from these embodiments. Previously disclosed elements are also shown.

Turning to FIG. **41**, therein is shown a view similar to FIG. **2** except that another embodiment **52** is shown. The female and male end portions **56**, **58** are essentially the same with the main difference being that inner cam ear **64** has only a single cam lobe portion **96** that lies in a side by side relationship relative to cam lobe portion **68** of the outer cam ear **62** wherein the cam lobe portions **68**, **96** are mounted on and spaced along a single, substantially centrally disposed axle **74** which axle **74** is mounted on bosses **78**, **80** so that the cam lobes **68**, **96** can pass through opening **88** so as to contact groove **86** on the male end portion **58**. The operation of embodiment **52** is similar to embodiment **48** and the steps of operation have been previously disclosed relative to embodiment **48** of FIG. **2** in that outer lever **62** is mounted generally in overlying relation outside inner lever **64** and must be opened first before inner lever **64** is opened because inner lever **64** is mounted generally underneath so as to be in underlying relation to outer lever **62**, thus, the longitudinal centerline of outer lever **62** is farther away toward the outside from the centerline **46** of female coupling **56** than the longitudinal centerline of inner lever **64**. The cam lobe portions **68**, **96** are mounted so that a face of one is contiguous with a face of the other.

Turning to FIG. **44**, therein is shown embodiment **52** as previous discussed showing embodiment **52** having similar elements as previously discussed relative to embodiment **48** of FIG. **21**. Also shown is a horizontal slot **188** provided across the entire width of the end of cam levers **62**, **64** for forming a receptacle for receiving a portion of ring member **114** therein for securing the ring member to prevent it from flopping around loose and becoming possibly tangled with other equipment and also to maintain the angled surfaces **126** of pin tips **124** in a proper downward disposition so as to properly and easily contact the retaining protrusions **128**, **130** (not shown, see FIGS. **23**, **24**). The slots **188** could be used with any of the embodiments related to the present invention including embodiments **48**, **50**. The lever latching mechanism or lock assembly **113** assist in preventing inner cam lever **64** from being inadvertently opened before outer cam lever **62** and to prevent cam levers **62**, **64** from being inadvertently opened together.

Turning to FIG. **50**, therein is shown embodiment **52** as previous discussed showing embodiment **52** having similar elements as previously discussed relative to FIG. **49** and additionally having a downwardly disposed hand guard, elbow or shield **194** on the end of outer cam lever **62** to assist in preventing inner cam lever **64** from being inadvertently opened before outer cam lever **62** and to prevent cam levers **62**, **64** from being inadvertently opened together. Hand guard **194** is intended to insure that the fingers or hand of a user grasp outer cam lever **62** first to be sure it is opened prior to grasping inner cam lever **64**.

Turning to FIGS. **51** to **56**, therein is shown a preferred alternative embodiment of the present invention **10** similar to that which was shown in FIGS. **41-50** with the main differences being that the pin housings **122** are mounted on the inner side, underside or inside of the levers **62** and **64**, i.e., on the side of the levers oriented toward the housing **56** as plainly shown in FIGS. **45**, **46**, and, the retaining protrusion **128** is mounted on a latch body **129** as opposed to a boss **78**, **80**. This configuration allows the pins **118**, springs **132**, and pin housing **122** to be similarly sized so as to reduce costs associated with manufacturing the present invention **10**. Also, no more than one cam lobe portion **68**, **96** is shown on each lever **62**, **64**. A person skilled in the art would understand how the embodiment shown in FIGS. **51** to **56** can be used according to the teachings of the present invention **10** as has been previously taught in this specification.

Also shown in FIG. **51** is latch body/retaining member **129** mounted onto the outer surface of the female coupling **56** proximate to inner lever **64** having a retaining protrusion **128** thereon along with a notch **131** for receiving the tip **124** of pin **118** of the inner cam lever **64** when in the closed or locked position. An isolated detail view also shows an alternative design for the retaining member/latch body **129** which includes an aperture **202** for receiving the tip of pin **124** of the inner cam lever **64** when in the locked position. Previously disclosed elements are also shown. Also shown is an isolated detail view showing an alternative design for the latch body/retaining member **129**, which serves the same purpose as the previously disclosed latch body/retaining members **129**, including opposing sidewalls **79**, **81** which are formed by a rearward extension from bosses **78**, **80**, respectively, for supporting a cross member **83** which extends between the rearwardly extending sidewalls **79**, **81** to provide a structure for supporting an aperture **194** for receiving the tip **124** of pin **118** as previously taught and disclosed herein. Furthermore, an alternative design to the aperture **194** would be to simply put a notch similar to the notch **131** of retaining protrusion **128** so that the notch could be used in place of the aperture **194**. Also note, that arm **62** has a round pull ring member **114** thereon similar to that disclosed relative to FIG. **31**.

FIG. **52** shows elements similar to those previously disclosed relative to FIGS. **21**, **44** and **51**.

Turning to FIG. **53**, therein are shown previously disclosed elements. Also disclosed are collar bushings, or bushing, **196** disposed on each end of the bore of the pin housing **122** of the levers **62**, **64** which bushings carry the pin **118** to allow it to smoothly slide back and forth in the bore of each of the pin housings **122**. Rear bushing **196** is press fit to the inside of the bore and the front bushing is press fit to, or made as a part of, the pin **118** and slides in the bore along with the pin **118** to assure smooth operation. Note that arm **62** of FIG. **53** has a pull ring member **114** which is made in the shape of a conventional metal spring clip hook which is commonly used on a lanyard or key chain. Note that arm **64** of FIG. **53** has a pull ring member **114** which is made in the shape of a paperclip having straight sides and rounded

ends. Obviously, there are other shapes of pull ring members **114** which could be used with the present invention **10**.

Turning to FIG. **54**, therein is shown a assembled view of the levers **62**, **64** similar to FIG. **53** illustrating that the levers **62**, **64** are substantially axially aligned to prevent unintentional movement of the levers **62**, **64** from the closed position to the open position as previously disclosed. Note that arm **62** of FIG. **54** has a pull ring member **114** having a diameter relatively larger than the pull ring member **114** of arm **64** disposed underneath wherein the diameter of pull ring member **114** of arm **62** is substantially wider being approximately 1.5 to 2.5 times as wide as the width of arm **64**. However, the width of pull ring member **114** on arm **64** disposed underneath arm **64** has a width approximately the same as arm **64** which makes it very difficult for a user to open the inner arm **64** and outer arm **62** at the same time but instead assures that the outer arm **62** will be opened before the inner arm **64** due to the fact that when arms **62**, **64** are in the closed position, the user's fingers **134** grasp the pull ring member **114** of the outer arm **62** first. After the outer arm **62** is opened, then the fingers **134** of the user can easily grasp the pull ring member **114** of the inner arm **64** to open arm **64**.

It should be clear that the pull ring member **114** can be made in various shapes, including, round (see FIGS. **31** and **51**, arm **62**, pull ring member **114**), a clip (see FIG. **53**, arm **62**, pull ring member **114**), a paperclip having straight sides and rounded ends (see FIG. **53**, arm **64**, pull ring member **114**) and, being rounded on one end and squared on the other (see FIG. **51**, arm **64**, pull ring member **114**). The various shapes and sizes of the pull ring member **114** provide a unique and novel ergonomic feature to the present invention which has heretofore not been used in this field of art of cam lock fittings but which provide a major advantage of the present invention over the prior art. In short, when viewed from above or from a top view, the present invention has an inner arm **64** pull ring member **114** which has a narrow profile (i.e., a smaller width or diameter) relative to the outer arm **62** pull ring member **114** which has a larger diameter pull ring member **114** thereon, so that relatively speaking the outer aim **62** has a much wider profile than the inner arm **64** to ensure that the outer arm **62** is opened before inner arm **64**. From an ergonomic viewpoint, the present invention **10** accomplishes this by making it more difficult to grip the inner pull ring member **114** on inner arm **64** relative to the pull ring member **114** of outer arm **62**.

Experimentation has shown that the ergonomic design of the arms **62**, **64** of the present invention **10** encourages the user to consciously visually look at the fitting/arms to separate/uncouple the female end **56** of the fining as opposed to the prior art which can simply be opened by feel without looking at the fitting, thereby leading to the user becoming careless in the operation of prior art fittings which can lead to accidents and spills. The present invention **10** thereby creates a safer working environment for the operator as opposed to the prior art.

Taming to FIG. **55**, therein are shown previously disclosed elements. Also shown is the manner in which the pin **118** of outer lever **62** connects to the rear lip **200** of inner cam lever **64** when the levers **62**, **64** are in the closed position. It should be clear that the inclined surface **126** of pin **118** of the outer lever **52** slides over and is secured to the bottom surface of the inner surface of the rear lip **200** of inner cam lever **64** while at the same time the tip **124** of pin **118** of the inner cam lever **64** connects to and is secured to the notch **131** in the latch body **129** by passing over the retaining protrusion **128** so as to securely lock levers **62**, **64** to the female conduit **56**. The pins **118** of the inner and outer levers **62**, **64** are each shown in locking position. The rings **114** of the levers **62**, **64** are prevented from rotating so as to disorient the inclined surfaces of pins **118** relative to protrusion **128** by being placed in close proximity to the underside of the levers **62**, **64**. Also shown is an optional protrusion or spacer **198** placed underneath the inner lever **64** which may be used to space the inner lever **64** apart from the outer surface of the female conduit **56**.

Turning to FIG. **56**, therein are shown previously disclosed elements while also showing how a finger of a user **114** or a thumb and index finger can be used to grasp the pull ring member **114** and pull it to the rear so as to open the levers **62**, **64** and to move them from the closed (locked) position as shown in FIG. **45** to the open (unlocked) position as shown in FIG. **46**. It would also be understood by one skilled in the art, that the pull ring **114** of the inner lever **64** cannot be grasped by a finger **134** and opened, prior to the pull ring **114** of the outer lever **62** being grasped to thereby first open the outer lever **62** because the pull ring **114** of the inner lever **64** is underneath the outer lever **62** and cannot be easily grasped. This is so because the centerlines, or longitudinal axes, of the levers **62**, **64** are positioned so as to be over/under each other or inside/outside each other and may be spoken of as being in aligned relation. Also illustrated in FIGS. **55-56** is an enlargement on the rear portion of cam lobe **68** as previously disclosed.

Turning to FIGS. **57-60**, therein is shown an alternative embodiment **211** of an improved cam lock fitting according to the present invention. The embodiment **211** disclosed is similar to a conventional prior art cam lock fitting **10** as shown in FIG. **1** and to the double lever versions shown in FIGS. **41-46** and **51-56**; however, the embodiment **211** allows portions of the fitting to be rotated by including a connecting collar **250** having a front end **252** and a rear end **254** with an outer annular peripheral flange **256** thereon which collar or circular sleeve is complimentarily sized and shaped for insertion into the inside of the female portion **212**. Also shown is the female end portion **212** being of a two-piece design having a first front section **258** and a second tail section **260**. FIGS. **58-60** illustrate the steps of assembling and operating the present invention showing how the connecting collar **250** can be inserted into the inside of the first section **258** of the female portion **212** and inside of the second, tail section **260** of the female portion wherein the first flange **256** contacts an internally extending flange **262** on the rear of the female coupling so as to be held firmly within the female coupling with the exterior surface **264** of the connecting collar **250** contacting the interior surface **266** of the front end **268** of the tail section **260** of the female coupling **212** wherein it is expected that the rear end of the connecting collar **250** will be press fit at **272** to the tail section **260** of the female coupling end **212**. The gasket or seal **240** is inside the female coupling **212** so as to be in contact with the flange **256** on the connecting collar **250** as shown in FIG. **59** so that when the male portion **214** is inserted into the female end portion **212**, the front end **216** of the male portion contacts the seal **240** so as to make a seal between the male end portion **214** and the female coupling **212** as shown in FIG. **60** when the ears **224** are closed. The rear end **270** of tail section **260** is shown with a barbed end in FIG. **58**, male pipe threads in FIG. **59**, and female pipe threads in FIG. **60**. The front section **258** is free to rotate about the connecting collar **250** while the tail section **260** is fixedly joined to the connecting collar as previously described and a sealing connection (See FIG. **60**) is made between the end **216** of the male end potion **214** and the

sealing gasket **240** and flange **256** of the connecting collar **250** as best shown in FIG. **60**. The press fit portion **272** between connecting collar **250** and tail section **260** is shown on FIGS. **59** and **60**. Also shown are groove **230**, opening **232** and lever portion **226** of arm **224**.

By way of additional summary and with reference to FIGS. **1-60**, the present invention may be described as a cam lock fitting **54**, a) having a male conduit **58** having an end **60** thereon and an external peripheral groove **86** adjacent the end, b) having a female conduit **56** for receiving the male conduit and having a pair of opposed side openings **88** opposite the external peripheral groove, c) sealing at **98** between the end of the male conduit and the female conduit, d) having a first and second pair of cam members, each pair having first (outer) **62** and second (inner) **64** cam members so that there are a total of four cam members, a pair, i.e., two, of the cam members being pivotally disposed on opposite sides of the female conduit, each cam member having a lever portion **66**, **70**, which includes what may be referred to in the claims as a lever arm for actuation thereof by an operator which identifies a part of the lever portion **66**, **70** that an operator would actually grasp with a hand or finger, lying adjacent the female conduit and a cam portion **68**, **72** with a larger or more effectively sized or shaped cam portion on the first (outer) cam member **62**, wherein the cam portions pass through the side openings and engage the external peripheral groove when the lever portion lies adjacent the female conduit in a first, closed position (see FIGS. **8** and **11**), each lever portion being outwardly moveable away from the female conduit to a second, open position to disengage the cam portions front the external peripheral groove (see FIGS. **10** and **13**), e) the male and female conduits being connected thereby preventing, leakage there-inbetween when each of the lever portions are in the first position (see FIGS. **8** and **11**); and, f) the male and female conduits being slightly separated, i.e., are loose fit, thereby allowing leakage thereinbetween when the lever portions of the first cam members are in the second position and the lever portions of the second cam members are in the first position (see FIGS. **9** and **12**), wherein if leakage is observed by an operator the lever portions of the first cam members are moved back to the first position to permit the male and female conduits to be reconnected.

Further, wherein the cam portions of the second cam members may be forked (see FIG. **19**), the forks having a space **110** thereinbetween, wherein the cam portions of the first cam members are pivotally disposed in a respective space wherein the first and second cam members pivot on a first axle **74**, or, wherein the first cam members pivot on a first axle **74** and the second cam members pivot on a second axle **90**. In an alternative embodiment, the inner cam lever **64** is larger than the outer cam lever **62**. In alternative embodiment **52**, the cam lobes **68**, **96** are disposed in a side-by-side relation (see FIG. **48**) while other elements remain generally the same. Also having a latching mechanism or lock assembly **113** having retaining protrusions **128**, **130** mounted adjacent each of the side openings and a pin housing **122** attached to each lever portion of each cam member, a spring **132** loaded pin or engagement member **118** within each pin housing which urges a distal end **124** of the pin into engagement or mechanical cooperation with one of the retaining protrusions to prevent each of the lever portions from being unintentionally moved from the closed position to the open position, and a pull member or member usable by an operator **114**, or the like, in mechanical cooperation with or attached to a proximal end **116** of the pins to allow an operator to withdraw the pin from engagement or mechanical cooperation with a retaining protrusion allowing each lever portion to be moved from the closed position to the open position.

Alternative embodiment **138** shows a cam member **144** disposed adjacent a first boss **80**, wherein a spacer **146** is disposed on the axle **74** adjacent the second boss **78**, wherein the first cam member **142** is disposed between the other cam member **14**$ and the spacer **146**. Alternative embodiment **140** shows the first cam member **160** disposed between the first **80** and second boss **154**, wherein the second cam member **162** is disposed between said second **154** and third boss **78**. A latch mechanism or lock assembly **147** could be used with embodiment **138** or **140**. Additional alternative embodiments are shown in FIGS. **31-35** wherein plate **168** is used for latching outer cam lever **62** and inner cam lever **64** to female end portion **56** and in FIGS. **36-40** wherein, plate **186** replaces plate **168** and latch mechanism or lock assembly **178** is used to latch outer arm **62** to inner arm **64**. An additional alternative embodiment is shown in FIGS. **51-56** where therein is shown a preferred alternative embodiment of the present invention **10** similar to that which was shown in FIGS. **41-50** with the main differences being that the pin housings **122** are mounted on the inner side, underside or inside of the levers **62** and **64**. i.e., on the side of the levers oriented toward the housing **56** as plainly shown in FIGS. **55**, **56**, and, the retaining protrusion **128** is mounted on a latch body **129** as opposed to a boss **78**, **80**. Lever **62** of FIG. **54** has a pull ring member **114** having a diameter relatively larger than the pull ring member **114** of arm **64** disposed underneath wherein the diameter of pull ring member **114** of lever **62** is substantially wider making it more difficult to grip the inner pull ring member **114** on inner arm **64** relative to the pull ring member **114** of outer arm **62**. Additionally, embodiment **211** discloses a rotatable cam lock fitting.

I claim:

1. An ergonomic cam lock fitting, comprising:

a) a male and a female conduit, said male and female conduits adapted for being connected to each other, said male conduit having an end thereon and an external peripheral groove adjacent said end, said female conduit having an end thereon and an internal seal disposed therein adjacent said end, wherein said end of said male conduit contacts said seal of said female conduit thereby preventing leakage when said male and female conduits are connected to each other;

b) a first and a second pair of cam members, each pair having first and second cam members, a pair of said cam members being pivotally disposed on opposite sides of said female conduit, each said cam member having a lever portion and a cam portion, wherein each said cam portion is adapted to pivot through an opening in a wall of said female conduit and into said external peripheral groove so as to removably join said male conduit to said female conduit, wherein each said cam member has a closed position when said male and female conduits are connected to each other and an open position when said male and female conduits are disconnected from each other;

c) each said second cam member having an inner lever portion and each said first cam member having an outer lever portion, wherein said inner lever portion and said outer lever portion are substantially axially aligned;

d) a first pull ring member disposed on said outer lever portion and a second pull ring member disposed on said inner lever portion for moving said first and second cam members from said closed position to said open

position, wherein said first pull ring member is larger than said second pull ring member as would be seen in a top view so that said inner lever portion is more difficult to open than said outer lever portion;

e) wherein at least a portion of said female conduit is rotatable about a centerline thereof; and

f) wherein when each said cam member is in said closed position, said inner lever portion is configured to mechanically cooperate with a retaining member disposed on said female conduit and said outer lever portion is configured to mechanically cooperate with said inner lever portion to prevent unintentional movement of each said cam member from said closed position to said open position.

2. The cam lock fitting of claim **1**, further comprising a pin disposed on each said lever portion of said first and second cam members, each said pin being biased for urging said pin into a locking position to prevent the unintentional movement of said first and second cam members from said closed position to said open position.

3. The cam lock fitting of claim **2**, wherein said pin on each said inner lever portion engages said retaining member and said pin on each said outer lever portion engages a rear end of said inner lever portion to prevent the unintentional movement of said first and second cam members from said closed position to said open position.

4. The cam lock fitting of claim **3**, further comprising a housing for containing said pin disposed on an underside of each said lever portion, each said housing having a bore therein wherein said pin slides in said bore.

5. The cam lock fitting of claim **4**, further comprising a pull ring actuatable by an operator and mechanically cooperating with said pin to allow an operator to move said pin for moving said first and second cam members from said closed position to said open position.

6. The cam lock fitting of claim **1**, wherein said cam portions of said second cam members are forked, said forks having a space thereinbetween, wherein said cam portions of said first cam members are pivotally disposed in a respective said space.

7. The cam lock fitting of claim **1**, wherein one said cam portion is disposed on said first and second cam member, said one said cam portions of said first and second cam members being disposed in side-by-side relation so that a face of said one said cam portion of said first cam member is contiguous with a face of said one said cam portion of said second cam member.

8. A method for assembling an ergonomic cam lock fitting, comprising the steps of:

a) providing a male and a female conduit adapted for connection to each other, the male conduit having an end thereon and an external peripheral groove adjacent the end, the female conduit having an end thereon and an internal seal disposed therein adjacent the end, wherein the end of the male conduit contacts the seal of the female conduit thereby preventing leakage when the male and female conduits are connected to each other;

b) providing a first and a second pair of cam members, each pair having first and second cam members, disposing a pair of the pivoting cam members on opposite sides of the female conduit, each cam member having a lever portion and a cam portion, wherein each cam portion is adapted to pivot through an opening in a wall of the female conduit and into the external peripheral groove so as to removably join the male conduit to the female conduit, wherein each cam member has a closed position when the male and female conduits are connected to each other and an open position when the male and female conduits are disconnected from each other;

c) providing an inner lever portion on each second cam member and an outer lever portion on each first cam member, and substantially aligning the axes of the inner and outer lever portions;

d) providing a first pull ring member on each outer lever portion and a second pull ring member on each inner lever portion for moving the first and second cam members from the closed position to the open position, wherein the first pull ring member is larger than the second pull ring member as would be seen in a top view so that the inner lever portion is more difficult to open than the outer lever portion;

e) rotating at least a portion of said female conduit about a centerline thereof; and

f) configuring the inner lever portion to mechanically cooperate with a retaining member provided on the female conduit and configuring the outer lever portion to mechanically cooperate with the inner lever portion when the first and second cam members are in the closed position to prevent unintentional movement of the first and second cam members from the closed position to the open position.

9. The method of claim **8**, further comprising the step of providing a pin on each lever portion of the first and second cam members, each pin being biased for urging the pin into locking position to prevent the unintentional movement of the first and second cam members from the closed position to the open position.

10. The method of claim **9**, wherein the pin on each inner lever portion engages the retaining member and the pin on each outer lever portion engages a rear end of the inner lever portion to prevent the unintentional movement of the first and second cam members from the closed position to the open position.

11. The method of claim **10**, further comprising the step of providing a housing on an underside of each lever portion for containing the pin, each housing having a bore therein wherein the pin slides in the bore.

12. The method of claim **11**, further comprising the step of providing a pull ring actuatable by an operator and mechanically cooperating with the pin to allow an operator to move the pin for moving the first and second cam members from the closed position to the open position.

13. The method of claim **8**, further comprising the step of forking the cam portions of the second cam members so that the forks have a space thereinbetween, wherein the cam portions of the first cam members are pivotally disposed in a respective space.

14. The method of claim **8**, further comprising the step of providing one cam portion on the first and second cam member so that the one cam portion of the first and second cam members are disposed in side-by-side relation so that a face of the one cam portion of the first cam member is contiguous with a face of the one cam portion of the second cam member.

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